Proceedings of National Conference on Concrete House Construction

Held at

Auditorium Hotel, Chicago

February 17, 18, 19, 1920

PROCEEDINGS

of

National Conference on Concrete House Construction

Held at

Auditorium Hotel, Chicago
February 17, 18, 19, 1920

Edited by the Secretary

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FOREWORD

Because of the almost entire cessation of home building during the war and the failure to resume such construction in a comprehensive manner since its conclusion, the actual shortage of homes has reached an alarming stage, and is still increasing. During the past two years transportation and labor difficulties among other causes, have prevented the resumption of house building on a scale comparable to normal times.

In recognition of this situation, the National Conference on Concrete House Construction assembled during February, 1920, "to consider the dwelling house problem and to present and make available the state of the art in the construction of concrete houses."

The National Conference on Concrete House Construction enjoys the distinction of having been the first gathering called by those interested in any great building material to study exclusively the housing shortage and to devise ways and means of standardizing the use and increasing the efficiency of that material in house building. The widespread interest which this Conference attracted is evidenced by the fact that architects, engineers, realtors, bankers, building material manufacturers and dealers, contractors, community planning experts, not to mention many individuals having their particular personal interests at heart, came from thirty-six states and from several provinces of Canada to meet with the Conference or to take part in its deliberations. Even representatives of several foreign nations were in attendance, eager for developments which might immediately be applied to their reconstruction or expansion problems.

This compilation of the Conference Proceedings is significant because of the comprehensiveness of the material presented and also because most of this material has never before been published. It is the last word on the ways and means of building the home dwelling of concrete in the various ways in which concrete may be applied to such construction.

It is hoped that these Proceedings of the National Conference on Concrete House Construction may rank as a noteworthy contribution to the cause of better homes and will prove valuable in encouraging a greater number of comfortable, artistic, fire-safe houses.

REPORT OF COMMITTEE ON RESOLUTIONS NATIONAL CONFERENCE ON CONCRETE HOUSE CONSTRUCTION

The United States and Canada are now confronted with an unprecedented housing famine, so universally recognized as to need no emphasis. This originated in governmental allocation of labor, materials and capital to war needs, and has been continued and accentuated by the diversion of labor, materials and capital to the production of non-essentials. To such an extent is this true that the public demand for these non-essentials, and even for luxuries, is raising the cost of housing, while the people are bidding against each other for the houses which exist.

The effect of this housing shortage is not merely to inflict hardships on the people, but to excite to higher pitch those feelings of discontent so widespread in the country since the war.

We deem it our plain duty as citizens to offer to our countrymen such advice as our professional and trade experiences qualify us to give, as to the best methods by which the problems may be solved and normal conditions restored. Only by an analysis of the factors entering into house building can we hope to arrive at an understanding of either the problem or its remedy.

Before entering on this analysis, reference must be made to the effect of the depreciation of the dollar which hangs like a cloud over the while business horizon. To the mass of people this is still a mysterious phenomenon. It began before the war, due to great increase in gold production and has, of course, been intensified by the inflation of the currency. While the people at large are thinking in terms of high prices they would be nearer the truth if they were thinking of lowered standards of value. The public view of this matter cannot soon be altered and we must, therefore, treat it for the present as an established fact.

The main factors with which we have to deal are more numerous than is the general belief; they involve among others, Land, Materials, Labor, Finance, Transportation, Design, Legislation and Building Ordinances. Clearly relief can come only through the construction of *more houses* of the right type. All building is for a profit in some form. Unless profit can be reasonably assured in residence construction the building of homes will be limited to prospective owners who are but a small fraction of the population of large communities. Houses must be provided for the great mass who can only afford to rent or buy on long term installments.

If, as will be generally conceded, after food supply, houses are the most fundamental need of the people, housing supply should take precedence over all other use to which capital can be put, and that we are justified in urging that all possible steps be taken to make investment of private capital in house construction more attractive than

any other form of investment. Investment can be encouraged but cannot be forced.

Private initiative has in the past always been found competent to solve the problems of the country, and with proper encouragement and incentive can be relied upon to successfully grapple with the present emergency. Federal governmental methods, even with the utmost efficiency of direction and handling, are slow, cumbersome and costly. Experience seems to show that every dollar which government puts into a competitive business drives out $10 of private capital.

In most of the states constitutional obstacles defer the possibility of help from these sources for at least two years. Prudence, therefore, dictates that the hope of such aid even were it desirable must be discarded from our calculations. What state governments can do, however, is to remove the obstacles which, in the form of taxation, they now place in the way of constructing new buildings.

Since the housing scarcity is the result of governmental restrictions and taxation, preferential allocation of materials and cars and governmental exemptions must be enlisted to restore normal conditions.

Land

Taking up the related factors, we may say in general that price and availability of land at present are such as not to be a serious obstacle. Unimproved land is held at low figures because of the difficulty which its owners find in putting it to profitable use. This condition in reality should act as a stimulus to building.

Materials

The widest latitude in the use of approved materials should be encouraged. Especially should this be emphasized for the purpose of relieving transportation congestion and the lowering of building costs. Because numerous sources of supply can generally be drawn upon, concrete is one of the most readily procurable building materials.

There is now a famine of houses. There is also a heavy demand for building materials for other and less important uses. Materials needed for home construction should be regarded as in an essential class, and as such be given preferred consideration in manufacture and distribution. Manufacturers of such materials should give priority in shipment when intended for this purpose, as opposed to other uses less essential to the public welfare. These recommendations should be brought to the attention of manufacturers of building materials and manufacturers of all other essential appointments entering into the completion of homes.

Labor

Full recognition should be given to the fact that the laborer's cost of subsistence has greatly increased. Every available means should be employed to call the attention of labor to the fact that it injures itself by arbitrarily retarding construction. Diminished construction results in high rents. These nullify the benefits derived from high wages to the extent of the advance in rents. Labor's attention should be directed to the fact that opposition to improved methods and processes

of construction will postpone, if not defeat, efforts to quickly increase the supply of houses, while the cooperation of labor in every unselfish, patriotic way will help labor as well as the whole people.

The urgent necessity of labor assuming its full responsibility in the production of satisfactory houses by the use of efficient and economical methods should be apparent to all.

Cooperation on the part of labor should be evidenced by its willingness to arbitrate all questions the non-settlement of which tends to retard construction and thus to increase its cost. The establishment of such organizations as the National Board of Jurisdictional Awards, whose purpose is directed toward minimizing the economic waste of such disputes, is to be highly commended, as it affords the best method yet presented for the settlement of questions between various building trades. This principle of cooperation should be extended so as to provide the means of settling questions in disputes between employees and employers without sacrificing the interests of the public or any of the parties directly concerned.

Labor should appreciate the fact that it cannot expect the support of public sentiment in any attempt to condemn the use of certain materials and methods of construction unless such methods and materials adversely affect the health and safety of workers or the public.

FINANCE

The principal financial legislation of the past few years has resulted in the establishment of the Federal Reserve System and the Federal Farm Loan System. The Federal Reserve System was designed especially to promote the facilities for commercial banking. The Federal Farm Loan Banking System was designed to promote the building up of rural communities. Up to the present, facilities for increasing the availability of money for improvement of city real estate have not been provided.

Partly as a result of the creation of the Federal Reserve System, money, during the past few years, has been drawn away from long term investments in favor of short term loans, with the result that, while savings in the United States are estimated to have increased 200 per cent from 1913 to 1918, and the total loans and discounts of banking increased 54 per cent, the combined real estate loans of banks and insurance companies and building and loan associations increased only 28 per cent in the same period.

In view of these facts, it appears necessary that this hitherto neglected portion of our banking system should be taken care of through adequate legislation.

One of the chief problems encountered is lack of funds to finance home building. It is desirable in the public interest that the funds now tied up in first mortgages held by the building and loan associations be made available for dwelling house construction and that the "Federal Building Loan Act," Bills S. 2492 and H. R. 7597 entitled "A Bill to Encourage Home Ownership and to Stimulate the Buying and Building of Homes; to Create a Standard Form of Investment Based on Building Association Mortgages; to Create Government Depositories and

Financial Agents for the United States; to Furnish a Market for Government Bonds; and for Other Purposes," be endorsed by this Conference.

Much money hitherto invested in first mortgages on dwelling houses is being diverted to non-taxable investment channels. It is desirable that exemption from income tax be granted to such investments. Bills S. 2094 and H. R. 8080, entitled "A Bill to Encourage the Building of Homes by Providing for the Exemption from Taxation of the Income from Mortgages on Real Estate" should be endorsed by this Conference; and we urge that members of this Conference write to their Senators and Congressmen, and endeavor to have others do likewise, urging them to support and favor the prompt enactment of these bills.

There is now proposed an amendment to the Federal Reserve Act requiring that National Banks maintaining savings departments shall invest all savings deposits in such forms of securities as may be directed by the Federal Reserve Board. Since the object of the proposed amendment is the adequate protection of the interests of depositors, and since its effect will be the diversion of more than two billion of dollars, now held in savings accounts, from short term loans to long term investment in construction enterprise—a sum equal to the present combined assets of the building and loan associations of the United States—the enactment of this measure is recommended.

Recognizing the fact that the building and loan associations of America are an important factor in financing home building and home ownership, and that these institutions confine their activities to teaching thrift and financing home ownership, we urge all organizations and individuals interested in promoting the construction of homes to affiliate and cooperate with building and loan associations in their localities and to assist in forming such associations where they do not now exist.

As the most difficult financial obstacle to the construction of homes is that of filling the gap between the amount obtainable on first mortgages and the amount the purchaser is able to invest, this Conference commends the work of community housing corporations and employers of labor who are using their own funds or credit to relieve the urgency of the present housing shortage.

Design

To secure results that will satisfactorily meet present housing needs, safety and economy in the construction of homes must be recognized as of paramount importance. These are attainable only through the use of the most adaptable materials applied by the best talent in design and construction.

It is, therefore, recommended that the organizations and individuals cooperating in the National Conference on Concrete House Construction enlist the cooperation of others not yet identified with the Conference to work with them in securing designs and specifications for small houses that will give proper recognition to the numerous advantages of concrete in its possible forms of application, and in this way help to increase and perpetuate the value of this Conference.

In order that these data may be made available to all who wish

to design, build or buy a home, we recommend the institution of a National Competition, with judges of such recognized standing as to inspire confidence necessary to enlisting best efforts of which contestants are capable, with prizes in number and value to attract such talent.

As an aid to the furtherance of this idea it is recommended that all interested submit data on every method by which concrete can be applied in the construction of houses, to enable intelligent selection and application of the best in design and specifications. The conditions of the competition should be made sufficiently broad to secure the support of engineers, practical builders or any others who have developed safe and economical systems of wall, floor and roof construction or any devices that will make houses more comfortable as a shelter, more attractive and cheerful as homes, and stimulate incentive to build houses for investment. Economy in erection, low cost of maintenance, reduction of fire risk and cost of insurance should anticipate the use of fire resisting materials wherever practical.

It is further recommended that a Bureau Committee of Information and Research be established to devise, promote and educate along lines conducive to more extensive use of concrete and the advancement of concrete design in home building.

TRANSPORTATION

Adequate building operations are dependent upon uninterrupted transportation at reasonable freight rates. The transportation systems of the United States and Canada have been and are insufficient to transport all traffic offered. The movement of building materials has been restricted and impeded by insufficient cars, and by preference accorded to other commodities in car supply, resulting in the serious curtailment of building operations.

Materials used in building operations, such as cement, brick, stone, lumber, steel, etc., are shipped in carloads. The majority of them are transported for relatively short distances only, and utilize the full cubical or weight carrying capacity of cars. Concrete construction forms an integral part of all building—often the entire structure—and requires a minimum of transportation. The average rail haul of a car of cement in normal times is approximately 175 miles, and the loading is to the carrying capacity of the car, while such building materials as sand, gravel, stone, etc., are usually secured at locations so near the job that they require relatively little transportation; hence concrete construction requires less transportation per unit of weight or measurement than other forms of construction.

The freight rates on traffic in general throughout the United States, on June 25, 1918, were increased 25 per cent as a war measure, while the average advance made in freight rates on building materials was 50 per cent. In the case of building construction, the transportation rate plays a very important part. The ratio of freight paid to total cost is higher with reference to building materials than to commodities in general; for instance, on sand, the rate of freight is often many times the value of the sand at the pit, while on a silk shirt the cost of transporting across the continent is so small a per cent of the selling price as to be negligible. Therefore, to increase the freight charges on building ma-

terials one cent per hundred pounds is to enhance the cost of the structure greatly. This is permanently reflected in the rental. An increase of even $5 per one hundred pounds in the rate on silk shirts would be barely noticeable to the purchaser. Any further advance in freight rates on building material will retard building operations and will serve to perpetuate and further aggravate the inequitable and unjust advance in the rates on building materials that was put into effect on June 25, 1918.

Instead of being classified as "Miscellaneous," building materials should be placed in a class by themselves.

During the remainder of the period of Federal control the U. S. Railroad Administration (and upon the return of carriers to private control and operation, the carrier corporations) in the distribution of empty cars, should subordinate shipment of building materials only to the movement of coal and essential food articles and should issue such priority orders as will insure the unrestricted shipment of building materials.

No further increase in freight rates on building materials and equipment should be allowed by the Interstate Commerce Commission or by the various State utility commissions having jurisdiction in such matter, pending the relief from the house famine.

LEGISLATION AND BUILDING CODES

It is urged that building officials give their support and influence in securing economies in construction by standardization of requirements for building materials and supplies of all kinds and the removal of undue restrictions applying to the erection of homes. It is particularly urged that legislative bodies enact more reasonable laws governing the use of concrete in the erection of houses so that the construction of better and more nearly fireproof and permanent structures may be encouraged as contrasted with an existing tendency to accept less desirable construction, while the users of better materials are frequently penalized by excessive requirements. The thickness of walls as frequently required by present building laws is greater than is essential to the safety of the structure. The requirements for the use of concrete in dwellings are fixed by regulations which govern the construction of warehouses. Light walls and floors, possible with concrete and ample for the needs of the ordinary house, are prohibited by these laws. Nor does the value of the concrete from the standpoint of fire protection receive the recognition it deserves. If these discriminations were removed there would be made available for more extensive use a material, to a large extent of local origin and employing local labor in its fabrication for the relief of the housing situation.

We submit the foregoing to all citizens and groups of citizens who may be interested in solving a problem rapidly becoming the most acute which the nation has to face. We believe that informed public opinion is the greatest agency for the accomplishment of necessary and desirable changes.

With the housing famine already of a most serious nature, we face an industrial development in which every thousand dollars invested in a plant would require about $5,000 invested in housing.

We submit that no one should rest content with informing himself as to this situation, but should make opportunities to impress upon others the necessity for putting into effect the foregoing principles.

That the use of concrete as a building material may make a substantial contribution to the solution of the housing problem is our substantial belief, and the more intelligent, comprehensive and effective the use of this material, the greater will be its contribution to that most desired solution.

These beliefs justify our meeting at this time to consider what aid we may bring towards solving a problem, the solution of which may accomplish more for the safety and welfare of the people than any other step that can be taken at this time.

They further justify the recommendation that this Conference be made a permanent organization, that the officers and advisory board be continued subject to such changes and additions as its membership may elect, and subject to their call for a second conference approximately one year from date.

In view of the many organizations affiliating with the Conference, whether because of their commercial interest in furthering the use of cement, or because in various other ways allied with or interested in the use of cement, the remarkable registration of nearly 600 persons, from all parts of the United States and Canada, indicates that the Conference might more correctly have been called "International." It is, therefore, recommended that in the call for the second conference, the name International Conference on Concrete House Construction be substituted for the present designation.

He serves himself best who serves his country best. He makes his own rights secure who respects the equal rights of others. The right to equality of opportunity is a statement of only half the case. There must be equality of responsibility as well if the Nation is to maintain its equilibrium.

Service for service is the law of life. The consciousness of owning a stake in the country is a prime factor in intelligent patriotism, since in this light the encouragement of home ownership assumes the aspect of a high civic virtue.

To clear away the obstacles which prevent every citizen who wills it from becoming a home owner, is a moral obligation upon everyone whose intelligence is sufficiently developed to enable him to estimate the importance of such a policy.

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OPENING SESSION

NATIONAL CONFERENCE ON CONCRETE HOUSE CONSTRUCTION

Conference called to order 2:30 p. m.,

Tuesday, February 17, 1920, by

ERNEST T. TRIGG, PRESIDENT
National Federation of Construction Industries

THE CHAIRMAN: The first matter on our program will be the reading by the Secretary of the call for this Conference.

CALL TO THE CONFERENCE

The shortage of houses in the United States has reached an acute stage. The need for dwellings has become so great that the subject is attracting more attention than did the food shortage during the war. Incidentally, confusion, inconvenience and direct loss caused by this situation must also be speedily relieved and presented. The housing problem in this country has progressed to a point where interest in its proper solution by commercial concerns has become a matter of national welfare rather than of opportunity to capitalize a current public need.

It is a truism that in a development of almost any kind, those who obtain livelihood by the execution of the plan, are the ones who may be depended upon for quick and sure action toward its enactment. In an emergency of this kind, however, the seriousness and the urgency of the public need for houses must make subservient all other motives for building them. Among all those whose labors are devoted to the planning or building of houses, there should be a feeling of personal and collective responsibility to contribute their maximum efforts for more and better houses. They should be expected to analyze the public need for houses and to plan intelligently to take care of that need. In so doing, every source of information should be canvassed and opportunity be provided for free and open discussion.

The organizations and individuals joining in this Conference come here at this time to study the broad aspects of the house problem and to crystalize and solidify ideas having to do with the building of concrete houses. The first reason for the Conference is fundamental, for without an intelligent grasp of the limitations and requirements, any move on the part of any industrial group looking toward the solution of the problem would be doomed in advance to only partial success at the best. The second reason for the Conference reveals the conviction of this group of industrial organizations that the concrete house has not contributed its share to the solution of the shortage, and also discloses confidence in their joint ability to solve many of the details of using concrete in house construction, which have proven troublesome in the past.

In shaping the preliminary organization for this Conference, the Secretary was mindful that the time allotted was limited. The date set was assumed to be as late as would be practicable, considering the desirability of putting into the hands of those to whom they would be of service during the building season of 1920, any of the constructive ideas which the Conference might develop.

The distinguished members of the Advisory Committee consented, by their acceptance of membership on that Committee, to sponsor the broad, general ideas on which this Conference is founded and to their help much of the interest in this meeting must be attributed.

It is not without significance that organizations throughout the country, interested in construction matters, have banded together in a strong cooperative national body known as the National Federation of Construction Industries. It is through the sponsorship of that great parent organization acting to assist this subservient group of building organizations, that Ernest T. Trigg, President of the Federation mentioned, issued the call for this meeting. He has been assisted in the work by Dr. W. K. Hatt, who is well known both through his connection with Purdue University and as President of the American Concrete Institute, and by F. T. Miller, President of the F. W. Dodge Co. of New York, whose notable work as Director of the Division of Public Works and Construction Development, Washington, D. C., last year, developed so much favorable comment in all parts of the country.

The organizations cooperating with the Conference are the following:

American Concrete Institute
Associated General Contractors of America
Associated Metal Lath Manufacturers
Building Officials Conference
Cleveland Cement Users Association
Concrete Block Machinery Association
Concrete Mixer Association
Concrete Products Association (National)
Concrete Products Association of the Border Cities (Windsor, Ont.)
Concrete Products Club of Indianapolis
Concrete Roofing Tile Association
Detroit Concrete Block Association
Greater Boston Concrete Products Association
Illinois Chapter, American Institute of Architects
Illinois Society of Architects
Long Island Concrete Products Association
Metal Forms Association
Minneapolis Concrete Block and Tile Exchange
National Builders Supply Association
National Federation of Construction Industries
Penn-Jersey Block Makers Association
Portland Cement Association
Portland (Maine) Concrete Block Association
Reinforcing Bar Association
St. Paul Concrete Block Association

Toledo Concrete Block Association
U. S. League of Building and Loan Associations
Western Association of Concrete Laundry Tray Manufacturers

THE CHAIRMAN: It is necessary at this time to consider the matter of our organization. I presume that the meeting should vote upon its officers for the remainder of its sessions and upon the question of appointing a Resolutions Committee. Has anyone any suggestions to offer as to the officers for the remainder of our sessions?

JOHN J. PORTER: I move that the temporary officers, who have so efficiently handled the work up to this time, be made permanent officers.

THE CHAIRMAN: The Chair finds it a little embarrassing to put that motion, but this being a matter of business and not a personal affair, if there are no further nominations all in favor of the motion please signify by saying "Aye."

(Motion carried.)

W. R. HARRIS: This Conference will, I believe, furnish opportunity for a great deal of constructive thought such as would probably be crystallized in the form of resolutions. We should do what we can to direct public officials' opinion to the merits of concrete construction for houses, which are badly needed. I, therefore, make a motion that a Resolutions Committee be appointed not only to draft resolutions, but to consider suggestions that will be made to it by persons attending this Conference.

(Motion carried.)

ADDRESS OF THE CHAIRMAN

Gentlemen of the Conference:

It has given me pleasure, as the President of the National Federation of Construction Industries, to accept the honor of the Chairmanship of the National Conference on Concrete House Construction. The honor I do not consider as accorded to me personally, nor to the National Federation of Construction Industries, but to an idea fundamental at this time to the construction industry of America, which during the year just closed has grown from a thought discussed around a dinner table to a living organism, the potentiality of which has already been demonstrated. I refer to the comparatively new conception of the construction industry as a composite whole which has come into the minds of the construction interests, not only of the United States, but of Canada, Great Britain, France and other countries. For it is true that in all countries at about the same time the construction interests came to a realization of the necessity of coordinated action and a central organization, through which these interests may become articulate in their relationships to the government, consumers and labor, and also through which additional effectiveness might be obtained within the industry by virtue of the cooperative action of its several divisions. It is therefore gratifying to me that I, who chance at the moment to be the President of the Federation which is the embodiment of this new thought of cooperative action on the part of many divisions of the construction industry, should be accorded the honor of presiding at this meeting, because of the faith which is evidenced thereby in this new conception of American business.

The past year has been the most critical of any in the memory of those present, not only in the construction industry, but in practically every line of business. The war came to a termination with startling abruptness. So far as the United States was concerned, we were barely getting into our stride as a warring nation. We had not reached the zenith of our ability in the production of war material, nor had we reached the utter demoralization of non-war business which would have surely been experienced had the war continued for a longer period. On the other hand, we had not reached a point where provisions were actively in process to lead the business of the country back into normal peace-time channels. Some one has described the condition of business immediately following the armistice as one of almost total paralysis.

Business in general experienced these conditions, but the construction industry was peculiarly beset with difficulty, not only because it was affected as were all lines of industry, but in addition because, since construction is essentially a peace-time activity, the wheels of the industry had largely stopped, personnel was disorganized and in many cases it was a matter of beginning in the rehabilitation of the industry at the very ground. We can never know how much of the injury worked upon the construction industry by government regulation was justified. The requirements of the Government for material, fuel, transportation, finance and labor were perhaps reflected more drastically in the con-

struction industry than in any other branch of business. But we had sons over there where the crisis of the world was focused in a sharp, hot point of the most bitter contention man has ever experienced. We believed in American institutions, and we were not disposed to do anything which might even indirectly minimize the safety of our blood or of the institutions which we love. There were some instances where construction interests were able to transform their activities into those contributing to the prosecution of the war. There were others where the Government actually required construction materials, but in general the construction industry, at the beginning of 1919, found itself in a condition of utter disorganization.

The story of its recovery is familiar to all of you. The path which it has followed during the past year has been full of pitfalls. The rapidity with which it has returned approximately to normal conditions is a monument not only to the genius of the leaders in our own industry, but to the American people as a whole, for we are interdependent in all of our business relations.

The year 1919 has been one of intensive advertising. This to a large degree, has been of a new kind. We have not so much advertised our wares, as ideas which it was necessary to inculcate on the minds of the people of this Nation before business could again be set going. The advertising has accordingly been largely group advertising, or, to speak more exactly, educational propaganda organized and paid for by the business interests which were bound to suffer if they could not put their arguments across in the popular mind. It is to the credit of American business that the educational propaganda which has been put out during the past year has been honest in its intention, logical in its argument and, as demonstrated, sound in its premises. It is probable that the American nation never before saw so great an educational campaign along any line as that which was waged to convince the American people that the then existing price levels would not be soon reduced. There was a period early in the year when nearly everyone believed that prices would shortly decline. As we all know, a declining market is not a healthful environment for business. The belief in the imminence of price decline was so universal that an attempt was made to pass through an imaginary maximum period of decline at once, in order that business might resume upon an ascending market. For a time it was hoped that through the efforts of the Industrial Board of the United States Department of Commerce such an object could be achieved. The failure of the Board to realize its purpose was undoubtedly a strong argument in favor of the permanence of higher price levels. An understanding of the psychology of the wage earner, of international financial conditions, of the advanced standards of living which had developed during the war and of the depleted condition of stocks of material, eventually made it perfectly apparent that prices could not be expected to decline, but that in many instances they would probably advance. The educational campaign which resulted from the realization of these fundamental facts was undoubtedly primarily responsible for the quick resumption of business. The construction industry had an important part in the campaign, and supplemented it with other campaigns, such, for instance, as the "Own Your Own Home" movement, in which all construction interests cooperated and which realized the most far-reaching results.

The National Conference on Concrete House Construction is an educational campaign in which all business interests vitally concerned therewith are cooperating. It is seeking to establish in the minds of the people of the United States an idea, which it believes fundamentally sound and the realization of which is expected to benefit not so much yourselves as the public at large. The American nation is notorious in the volume of its fire losses. You are seeking to show a way by which the capital wealth of the United States may be conserved. It is an interesting commentary upon American business that insurance interests should cooperate with you in an endeavor to convert the people of this nation to a form of construction where fire hazard is diminished, and that those interests supplying fire protection equipment are also working to educate the American builder and property owner to forms of construction where the danger from loss by fire is decreased.

Construction is as old as civilization. It is older than the records of civilization, or, to speak more exactly, the records of the most ancient of our forms of civilization are contained chiefly in the monuments of their constructive art. The massive stone structures of Egypt and the crumbling bricks of ancient Assyria are among the earliest evidences of the industry of man.

The use of portland cement, like the use of steam, is an acquisition of modern science. It is buried deep in the earth to form foundations of structures which in size fairly rival the pyramids of old. Of it highways are constructed having the permanence of the stone roads of ancient Rome. It is fashioned in the form of bridges, which are as substantial as native rock and promise to be as enduring. In the decorative art, it is molded into graceful forms with all of the delicate tracery of the artist's hand. This wonderful plastic rock is one of the newest of construction materials. Its use today in common practice is perhaps still crude as compared with what it will be tomorrow. The applied science concerning it is too young for us to suppose that cement has reached its final structure or to imagine all of the uses to which it may be put.

It is peculiarly fitting that you as representatives of one of the newest and most important of construction materials should adopt the advanced methods here evidenced in your business practise. You are assembled, I take it, for a number of reasons. You desire to wage an educational campaign. You wish to sell the people of America an idea. At the same time you are not willing to rest upon the laurels which you have so fairly won, but are determined if possible to advance your art to even higher stages and to instruct your workmen in the methods by which most creditable results may be obtained. You have common interests. You are willing to work in unity. You are here to exchange with each other the knowledge and experience and ideas which have come to you since you last met together. You desire, if possible, to seek out new means of research which shall benefit not only you but your public. This is an excellent illustration of the motive which should prompt all of us in the construction industry, for whether we are interested in cement or brick or steel or preservative materials or lumber or lime or building hardware, or any one of a hundred other things entering into construction today, we are all members of one great indus-

try, the greatest industry in the United States, and hence in the world, the industry which is supreme in the production of those things which remain permanent in the possession of the people of the capital wealth of the nation. It is this thought which has led the Federation to adopt the pyramid as a symbol of permanence and stability.

I say we are members of the greatest industry in the world. In normal times the construction industry of the United States produces Three Billion Dollars of added permanent taxable wealth annually. It supplies more than one-quarter of the railroad tonnage of the country. It employs more men than any other industry. Its activities are extended into the smallest communities; its influence is felt in many lines of business not directly connected with it.

We have issued from the travail of a great war, which has abruptly swept aside some of our oldest traditions. Business is advancing along new lines. International relationships have taken on new aspects. The methods by which we must carry on our business in the future are aptly illustrated by the spirit which prompts this National Conference on Concrete House Construction. This spirit is one of working together for the common good of those in your industry and of your patrons.

It is this same spirit of cooperation which must carry us even beyond the admirable motives which prompt your Conference. We remember the results which it was recently possible for us as a nation to obtain through concerted action, but I fear we are prone to forget that a similar concert of action is at this time as vital to the welfare of the people of this country as it was during the war. I have previously referred to the disorganized condition of business which existed at the beginning of 1919. The very pressure of circumstances has resulted in a volume of business during the months just passed which has been truly phenomenal. We have, however, not passed out of the stage of reconstruction. Concerted effort in the attainment of stable peace-time conditions is today of the most vital importance to all of us. I sometimes wonder if our present prosperity is truly indicative of a soundness of business. I raise the question for your consideration, whether it is not possible that we shall in the near future be rudely awakened from our almost complete absorption with the things of today to find that our failure to have attended beforehand to some of the things of tomorrow has resulted in an unfavorable reaction.

The present is a day of violent anomalies. Leaving aside the question of the purchasing power of a dollar—which in the final analysis is purely relative—we find that there is a universal demand for better living conditions, accompanied by an equally insistent demand for more hours of leisure. If at any time in the history of a people the standard of living is suddenly elevated to a new plane, the effect economically is the same as if there had been a sudden addition to the population of millions of non-producing consumers. The corollary of a higher standard of living, which is most laudable in itself, is undeniably increased production. We cannot consume that which is not produced. If we would have more of this world's goods, as a nation of over one hundred million souls, we must produce more goods. It is not a question of our individual purchasing power. We cannot buy that which does not exist. It is emphatically a question of our collective producing

ability; and it is a fact, according to those who should be in a position to know whereof they speak, that while the per capita demand for commodities is increasing in a way never before experienced, the per capita production of commodities is decreasing. If by the magic of some Aladdin's lamp we were to be able suddenly to place in the hands of every person in the United States a million dollars in gold, the condition whereof I speak would not be altered in the slightest.

If the new price level is approximately permanent, our business, other things being equal, can continue unhampered. The significance of the new price level, excepting considerations of international exchange, involves only the larger circulation of currency; but the relationship of production to consumption, if the latter is larger than the former, must inevitably result in ruin through the opportunity thereby created for the further exploitation in price of the commodities which are available. So long as consumption exceeds production the opportunity for profiteering not only exists but is strongly tempting.

The National Federation of Construction Industries, realizing this condition, has warned the component elements of the industry from time to time as to the danger to the public welfare which is inherent in further increases in price; and I am happy to say that notwithstanding the fact that in many instances demand has exceeded supply, the percentage advance in the cost of construction materials has been kept well below the average of the advance in price of all commodities.

The questions of thrift and of production are of transcendent importance to the public welfare at this time. They have called for an educational propaganda which is still in process, and which in some particulars is more difficult than that which related to the permanency of the new price level. Until a proper psychological balance shall have been restored in the minds of our people as to these two economic factors of production and consumption, our nation is in danger. Until this balance shall have been restored, we shall remain in what some have chosen to call the reconstruction period, during which period our only hope lies in concerted action, not for our individual good but for our collective welfare.

There are other strong considerations which demand our attention. We are approaching a time when by constitutional provision we shall determine upon the political leadership of our Government for the next ensuing period of four years. It is a period which will be marked by decisions and determinations of policy of the most far-reaching importance. The Government has played a more intimate part in the business affairs of the nation during the past few years than ever before in our memory, and it is apparent that to some degree at least this intimate relationship will continue for some time to come. Business is not, as some of the uninformed would tell us, an affair of capital. The conditions of business affect the whole people and upon its proper guidance depends the welfare of all of us. It also involves, to a greater degree than ever before, questions of foreign relationships. The unprecedented condition of world finance and exchange requires in its handling the highest ability. The leadership of our country and the formulation of policies during the immediate future should not be left to professional politicians or theorists. Our final emergence upon a broad plain of

substantial economic security as a nation is conditioned upon the same quality of administrative guidance which characterizes any well organized and operated business. The situation which confronts us calls most emphatically for a business man of the highest order as the next President of the United States, one who will surround himself with cabinet officers of recognized administrative genius. The present is not a time for political spoils or partisanship or petty jealousies. Our need for concerted action to accomplish the restoration of the country to its former strength and stability was never exceeded by the requirements for unity of endeavor during the war. Notwithstanding this fact, strong partisanship is evidenced at the present moment. Many of our political leaders of both parties, apparently heedless of the seriousness of present conditions, are engrossed with the search for party issues which will insure factional success, while organized labor seeks to discover a method by which the Government may be deprived of the elective service of American citizens who do not bear the symbol of class rule—the union label. These are considerations which make it not only desirable but necessary that as business men we shall give more attention to matters not immediately concerned with our business. The spirit which prompts the National Conference on Concrete House Construction is one of unity of action. It is a spirit which should actuate us even in larger groups of interests than are here represented. The combined construction industry, when it is completely organized, will become one of the most powerful forces of the business world.

I am reminded of a quotation which I saw a few days ago: "He who builds for himself alone is a complete failure even though his towers touch the sky and death breaks his grasp on a billion." Your assembling here is a testimony of your belief in the ideal of cooperation. For this reason, it affords me a peculiar pleasure, as Chairman of your Conference, to welcome you here and to extend to you my most sincere hope that you may accomplish to the fullest degree those things of which you are so eminently worthy.

THE CHAIRMAN: It is with regret that I have to announce that Senator Calder finds it impossible to be with us today. He has, however, sent to the Secretary of the Conference the following telegram:

(COPY OF NIGHT LETTER)

Washington, D. C., February 16, 1920.

A. J. R. Curtis,
National Conference on Concrete House Construction,
Auditorium Hotel, Chicago, Ill.

I regret exceedingly that pressure of public business here prevents me from keeping my engagement to speak at the National Conference on Concrete House Construction at Chicago on Tuesday. I know that you are aware of the fact that I am deeply interested in the subject of building construction and looked forward with pleasure to meeting the members of your organization and discussing with them the problems that are confronting us. I am in accord with the purpose of the Conference to bring about a more efficient use of cement—one of the most essential building materials—and I trust that the example of the progressive cement industry may be followed by the clay products industry, the lumber industry and the tile industry, manufacturers of elevators, plumbing goods, etc., in speedily meeting to consider methods of standardization of their products and possible uses of their by-products, for it is chiefly through the more efficient use of building materials and through the standardization of building construction that it may be possible to reduce the cost of building, which is otherwise dependent upon freight, fuel and labor rates. It is to be hoped that a more adequate system of long term credits may soon be devised which will restore to the building industry adequate financial resources.

(Signed) WILLIAM M. CALDER.

THE MORAL VALUE OF THE INDIVIDUALLY OWNED HOME

By Dr. John M. Vander Muelen, D. D.,
Pastor, Oak Park Presbyterian Church, Oak Park, Ill.

In one of Billy Sunday's splendid perorations he tells us of an American, not very famous, whose remains were brought here in 1883 from Tunis, Africa. He had been an actor and a playwright in his day, but all that he had done in that line had been forgotten. He wrote a number of poems, but you will scarcely find them on any of the shelves of the libraries that you know. He was appointed Consul to Tunis, but won no distinction there. Yet in the year 1883 this Government, because of the sentiment of this great American people, sent for his body, big guns were fired as the body came into New York upon the ship that had been sent for it, he lay in state in Washington, great orators spoke their tribute over him and people stood with their heads bared as his coffin passed by.

If you ask what conquests he had won, there are none; what great book he had written, none; what great policy of statesmanship he had evolved, none; what great scientific experiment and achievement he had wrought, none; what great discovery he had made, none; why was it that over all this country men stood with reverent hearts as his body was laid in the grave? It was just because he had once written a song that touched the heart and the man who can do that does a great thing.

And this was the song. I will read only a verse or two of it. You may not remember it all or know it all, but these verses you will probably know.

'Mid pleasures and palaces though we may roam,
Be it ever so humble, there's no place like home;
A charm from the skies seems to hallow us there
Which, seek through the world, is ne'er met with elsewhere.
Home, home, sweet, sweet home,
Be it ever so humble
There's no place like home.
An exile from home, splendor dazzles in vain;
Oh, give me my lowly thatched cottage again;
The birds singing gaily, that came at my call,
Give these with sweet peace of mind, dearer than all.
Home, home, sweet, sweet home,
Be it ever so humble
There's no place like home.

I want to ask whether that sentiment has grown stronger in our American life or less strong? It is my conviction that it has grown less strong, and I want to defy you—because I may say in advance that I want to make a contrast this afternoon between the individually owned home and the apartment house—I want to defy you to translate the sentiment of that song into terms of the apartment house.

I suppose that there are two elements which are implied always in our thought of a home, although they may not be exactly in the definition. One is that as the dictionary says, it must be a fixed place of

abode. An apartment house isn't that and so you can't translate that sentiment into it. Let me try. Instead of saying "Home, home, sweet home, Be it ever so humble there's no place like home," let's sing a song to the apartment.

To movies with autos though we oft went
There's no place on earth like our apartment.
Rooms, rooms, sweet, sweet rent,
There's no place on earth like our apartment.

That doesn't put a choke in your throat, I notice, and it doesn't bring a tear to your eye, and if you'd say that to your children, they'd say, "Daddy, what apartment do you mean? The one we live in this year or the one we lived in last year or the one we were in five years ago?"

It takes some measure of time to cultivate the tender affections that cluster around the word "Home." I think that likewise there is implied in this word "Home" the fact of individual ownership, for the reason that men change so often is because they don't have the pride and satisfaction that comes from ownership. You and I have all realized that the moment we own a thing we take a new interest in it. Suppose it is a horse. You are very critical of it before you buy it, but when you have bought that horse, there's no horse in all the world like it. It's the same with an auto. Its' even the same with a wife.

You remember that Shakespeare makes one of his characters say of his wife, "A homely thing, but all mine own," and that makes all the difference in the world. I think that man felt that way when he said to a man upon the train, "Who is that homely woman sitting the third row from the back?"

"That, sir, is my daughter."

"Oh, no, that isn't the one I mean. She is handsome, but the one in front of her."

"That is my wife, sir."

And then the man, because he was so tactful, regained his composure very quickly and said, "Oh, that's nothing; you ought to see mine!"

We take a surpassing pride and satisfaction in that which belongs to us, no matter what it is, and all the pride and satisfaction in home is lost when we don't own our own home. So when I speak about the moral value of a home, I mean the individually owned house that seems to be implied in the term, and I want to speak of three moral values this afternoon. The first is to the individual and the family, the second is to the community, and the third is to the church. There is a great moral value in the individually owned house to the individual and to the family from the standpoint of economy. The word "save," or the concept that is in it, is the foundation of all religion, but it is the foundation of all business too; and it is of great moral value to a character just to have learned to save. The easiest way for a man to save is to save for a home.

It is said that an old farmer once went to hear Spurgeon preach. Spurgeon was preaching upon "Money." The old farmer, who had

been induced to go to church to hear him, was greatly edified by that sermon, for the first point Mr. Spurgeon made was "Make all you can." The old farmer, somewhat of a miser in nature, rubbed his hands in satisfaction and said, "What a wonderful sermon! Was there ever a sermon preached like that?"

Then as Spurgeon went on, he came to the second point and that was, "Save all you can." Then the old farmer could hardly keep his seat he was so enthusiastic. He said, "I never heard preaching in all my life like that!"

Then Spurgeon came to the third point and that was, "Give all you can," and the old man said, "Oh, dear! Oh, dear! Now he's gone and spoiled it all."

There is a great value in making all we can but we Americans don't need to emphasize that. There is a still greater moral value, I am sure, in giving all we can but I question whether we in America need in this day to emphasize that very much. But there is one thing surely which America needs to have emphasized today and that is the moral value of saving all we can. I sometimes have seen the miser's character belittled in behalf of the spendthrift's and perhaps the spendthrift is a better fellow to deal with than the miser. I am not sure, for I am somewhat convinced that the selfishness of the one matches the selfishness of the other. But however that may be true, America is in no danger of being miserly. The one great danger of America today is that she will be a spendthrift.

The easiest thing for which a man can be appealed to in the way of saving is just to own his own home. All the interests of beauty and of love center around the home and a man will save for that when he will save for nothing else. So, it will go into the making of his character.

The second moral value of an individually owned home is a sense of responsibility. Professor Seeley in his book on "School Management" compares the boy who comes from the country with the boy who comes from the city in favor of the former, and he thinks the reason that so many great characters have come from the country in this nation of ours is because of that sense of responsibility,—the little chores that the boys in the country must do, the keeping of his pet animals and one thing and another. But it is especially true when you compare that boy from the country with the boy who grows up in an apartment rather than a home.

There are no furnaces for the boy in an apartment to tend. There are no walks to be swept, no garden to beautify. There are no cares of the home that devolve upon him. This carefree sort of life never develops character. Men are developed by responsibility, and when a man owns his home, both he and his boy learn something from it.

It seems to me that the third moral value of the individually owned home for the family is in the effect it has upon our affections. A man that has something to do with the enlargement of the affections and cares of the human heart does a great thing for mankind. The editor of the Independent said sometime ago that the dweller in an apartment house did not make deep and lasting friendships with the neighbors. He moves too easily; old friends are forgotten, new acquaintances never

or seldom ripen into those true friendships that can come only through the years. I believe that the editor of the Independent was right. But he said that he didn't think the purity and strength of character was impaired by dwelling in an apartment house; that only the neighborhood dwindles. In that respect I believe that the editor is wrong. He is first of all wrong when it comes to the homes of the poor. "I never wanted anything in those houses," a woman said in Isabelle Horton's book on "The Burden of the Great City;" "I never envied anything in those houses but the room. From childhood on I never had enough room. I believe we of the poor could love each other more if we had more room. There were so few beds that one of us always had to sleep at the foot, and I remember when I was a little one and I had to sleep at the foot how I dreaded the inevitable kick that was coming during the night and how I would jump when it came. I believe we poor people would love each other more if we only had more room."

Benjamin Rosenthal, in a speech made here in Chicago last month, gave some descriptions of some terrible housing conditions among the poor in this great city of ours, and he said that you can no more expect chastity to come out of those houses than you could expect perfume to come out of a garbage pail, that it just isn't possible for a man to be clean and bring up his family clean in a sexual way where people are crowded like they are in these tenements. I believe this is not merely true of the poor people but it is true of the middle class—that the individually owned home tends to the promotion of all that is good in family life.

The apartment house stands, first of all, for the production of that which Theodore Roosevelt so much feared, and that is race suicide. I think that I belong to the middle class and I remember that when our baby was born we lived in an apartment house. We were in a three-story apartment house. There were no elevators in it. My wife wasn't a very strong woman and we used to put the baby carriage in a place under the stairs out of the way in the front hall until the people downstairs complained that they didn't want to see a baby cab there. So we had to take it upstairs, with the result that the baby wasn't taken out so often.

After awhile the little fellow grew and had one of these kiddie-cars, and his great delight was to ride from the sitting room into the kitchen and back again, until the people downstairs complained, and he couldn't ride in his kiddie-car any more.

At night sometimes, and sometimes in the daytime, we had to discipline him. Solomon said, "Spare the rod and spoil the child.' But Solomon never lived in an apartment house for as soon as you discipline a child in an apartment house, you're going to hear from the neighbors.

So, all the crowding of neighbors in an apartment house goes to destroy the power that a man has to run his own home in the way that he wants to run it, and in these and in very many other ways you have a destruction of moral values. All these tender sentiments of our hearts cluster about a place where our father and mother have lived and we have lived steadily through the years of boyhood. I go back to my old boyhood days in Michigan and there's the old home—the old home where I can remember this and that little scene—the place where I can

remember my mother once saved the life of my sister, the place where she lived herself down and died in the old home, and the tender farewells that she spoke, and those memories not merely cluster around the woman, my mother, but around that home, too.

I remember that some years ago I went to deliver a baccalaureate address in Washington & Lee University. I was put in the home occupied by General Robert E. Lee. I slept in the bedroom in which he slept and I went into the stall of Traveler (which still stands there)—the great horse upon which he rode. I put my hand in Traveler's manger. I sat down at the desk in General Lee's old room and wrote a letter to my boy. All the associations clustered around that home. We make voyages to the home of Abraham Lincoln. The place is still there that makes him still dearer.

How many a lad has come back from his wanderings tied to the memory of his old home and his mother? Why, if the Prodigal Son had lived in this day and age and he had said, "I will arise and go to my father," he wouldn't have known in what apartment house he could have found him!

There is a moral value in the individually owned home not only to the family and to the individual but to the community. I want to lay this down as a fundamental proposition—that the interests of every community depend upon the responsibility and the love and the interest of the members of that community itself. It is true first of all in a material way. People from the outside with capital may come to promote the community but it can't last long if that community allows its public highways and its buildings to go to rack and ruin, to run down at the heels. If it isn't interested in the material welfare of its own community, it isn't going to attract capital there any more. It's going to go down materially, it's going to go down in an educational way.

Over in Oak Park, the community from which I come, a village of about 30,000, we have one of the best superintendents of schools in the whole country, but there are political influences out to put him out today. Are we going to hold him? That will depend upon the interest which the right-minded people of Oak Park take in their school system.

It is just so with morals, too. Whether there are going to be any places of immorality, any subtle institutions of immorality, like many of the moving picture shows, to deteriorate the morals of our boys and girls of Oak Park, depends upon the citizens themselves and the interest they take in it—nobody else. I want to ask whether it is possible that people who live in an apartment house should take the same interest in their communities in any one of these ways that the people do who own their own homes?

The Saviour once said, "Where a man's treasure is, there will his heart be also," and every renter of every apartment in Oak Park knows that if the conditions are such that he doesn't like them any more, he can easily pick up and move out. That is why, in the words of Otto W. Davis, Secretary of the Chamber of Commerce of Minneapolis, every apartment neighborhood in every city tends in the course of time to become a tenement neighborhood.

It is true also of Americanism, that if we can produce individually owned homes we are going to get rid of bolshevism.

I want to quote further from what Mr. Rosenthal said in the speech to which I have already referred. He said, "You wonder why we have our appalling labor turnover. That question is easy of solution. What incentive do you give to that man who works hard all day, who, when he has finished his work at night, goes home and finds nothing but squalor and dirt and noise? Naturally, he soon becomes indifferent, his efficiency wanes, he is not anchored, he doesn't own his own home and then he drifts away. That is why you have this labor turnover."

Think what it would mean to these workmen if they owned their own homes. They have that same yearning to own the roof over the heads of their families that is in your heart and my heart. The sense of proprietorship that comes in the owning of a home forestalls the danger of the red flag of bolshevism. Instead of building up bolshevists as we are doing today, if you could give laboring men their own home you would be manufacturing a class of citizens that would be fighting not for our country but for the preservation of our homes and of his own home, too.

In the brave hymn of Marco Bozarris that we used to declaim so eloquently in our youth was this call to arms:

"Strike for your altars and your fires,
Strike for the green graves of your sires,
God, and your native land."

But you know, in an apartment house we haven't any fires to strike for and the green graves of our sires are away over in some other community, and when a man hasn't any fires nor any green graves of his sires, his sense of patriotism is impoverished. You give a man a home and he knows what his country stands for. It stands for that home and the home stands for his country and he is a new patriot.

Last of all, the individually owned home has a great moral value for the church. I am sure that you men believe in the church. I don't see how you can help it since the great authorities in business believe in it. I have here a pamphlet by a great authority in business whose name you all know, Roger W. Babson. I suppose that some of you have read his report of last January 27th. I just want to read two or three sentences of it. He says, "What is our real security for the stocks, bonds, mortgages, deeds and other investments which we own?" And then he goes on to say, after the discussion, "It means that the real security for the stocks, bonds, mortgages, deeds and other investments which we own is the integrity of the community. The steel boxes, the legal papers and the other things which we look upon as so important are the mere shells of the eggs. The value of our investments depends not on the strength of our banks but rather upon the strength of our churches." Then he closes with this exhortation—"For our own sake, for our children's sake, for the nation's sake, let us business men get behind the churches and their preachers. Never mind if their theology is out of date; that only means that were they efficient they would do very much more. The safety of all we have is due to the

churches, even in their present inefficient and inactive state. By all that we hold dear, let us from this very day give more time, money and thought to the interests of our city, for upon these the value of all we own ultimately depends."

Theodore Roosevelt gave nine reasons for going to church. The first one was that he said in this world of ours the community that has let its religious interests lag, that has scoffed or become indifferent, is, he said, a rapidly declining community.

The apartment house has a great effect upon church life and I can illustrate that in a very easy way. Not very long ago one of the best workers in my church (I had appointed a number of them for a new job) wasn't doing the work as faithfully and efficiently as was his wont. I couldn't understand it. He was one of the most conscientious and consecrated workers in the church. I went the other day to his home and found he had sold his house and was thinking of moving. He didn't know whether he would ever be in Oak Park any more. Some day he will pick up that interest again when he knows where he is going to be permanently but for the present he has lost his interest.

For three years I was the pastor of a church in New York City where we had scarcely any but apartment house dwellers. Every summer when I came back from my vacation, I'd see a goodly percentage of my flock gone. I'd have to break in a new set again. But the folks would tell me that they didn't want to identify themselves with any church because they didn't know whether they'd be there this year or next year, and so they got to drifting, postponing that important relation until at last it had perished out of their lives altogether. Meanwhile the church from which they had come had lost a member and the church in the neighborhood to which they had moved had gained none.

The church has a very great interest in this matter. I just want to say this in conclusion, that in this day and age of ours, the individual isn't smarter than he was in any other day. Professor De Quatrefages says that the skulls of the past show that the average Athenian was as much more keen and brilliant intellectually than we are as the average American is more keen and brilliant than the African negro. But in one respect we have put it all over the past and that is in the power to do things cooperatively; in the exemplification of the principle that in unity there is strength.

For the sake of America and of all the things that are best in America, that company of men do a great, patriotic thing, as great as the abolition of the liquor traffic or the abolition of militarism, who make it possible for men, citizens of this country, to own their own homes. I give you this poem of Victor Starbuck's as an inspiration and a prophesy:

"We have molded for ourselves telegraphs and tunnels,
Builded bridge and barrack-room, derrick, dock and gun;
But for love of women we have builded little houses,
Pleasant in the shadows and peaceful in the sun.
All the wide world over there are little houses,
Silent in the starlight, shining in the dew;
There with children's laughter and the loving hearts of women,
God, the mighty Builder, builds the world anew."

Residence of Fred Evans at Newark, Ohio. A pleasing example of individuality of reinforced concrete for residences.

Refined elegance, permanence and adaptability of concrete is presented in this residence of Ernst Venn at Detroit, Mich.

CONCRETE HOUSING

By Irving K. Pond, Architect, Chicago.

I have written so much abstractly on architecture and architectural principles that it is good again to get down to hard and fast matters and fix my hypotheses in the concrete. I say "again," for many years ago, as Chairman of the Committee on the Allied Arts of the American Institute of Architects I was the author of a widely circulated report of that Committee dealing with concrete as a medium of architectural expression. I have had but slight occasion to put into practice the theories I then advanced, but I have continued to hold, and still maintain them.

Since that time the use of concrete in building operations has grown apace and enthusiasts and specialists have arisen to scatter their words and their works broadcast, sometimes, though not always, the words being more attractive than the works—sometimes the words and works alike bordering on the atrocious—as for instance when the beauties of cast rock-faced-concrete block have been urged and the monstrosities themselves have made pitiable what otherwise might have been semi-respectable structures—"semi," mind you, not "wholly" respectable; for the taste which could advocate, and incorporate into its product, such base imitations could not create or fashion a thoroughly respectable structure.

Some two years ago while acting as chairman of a board to adjust and settle perchance, jurisdictional differences between the carpenters, the architectural iron workers and the sheet metal workers of Chicago, I suggested facetiously that the fabricators of imitations should be penalized by giving over to the trades whose products were imitated the erection of all such imitations. Thus stone masons should erect all tin fabrications simulating stone cornices, architraves or entablatures; and do plastering where plaster simulated Caen stone—one might put it "con" stone—on walls and in vaulted ceilings. My pleasantry was met with hearty and strenuous disapprobation, each trade wanted to tell its own little lie and to reap the benefits which each felt certain would accrue to it in a world so slightly endowed with the elements of sincerity or of good taste.

So my first item of advice, if I may be permitted to offer advice to a body of men interested in the development or handling of a comparatively new and altogether worthy building material, is to treat the product with respect, to shun and scorn imitations, to recognize limitations, which attach to all materials, as well as to all men, and to work within those limitations. This is not saying that because a thing has been done, and frequently and appropriately done, in one material it shall not be done in another or a new material which may be employed with equal propriety; however, the new material should not employ forms which are purely distinctive of the old, but should develop forms which inherently characterize the new.

What these characteristic forms may be is a subject for very search-

ing study and analysis. Possibly through synthesis rather than analysis will the characteristic forms disclose themselves. So was it in the past with the old materials—so probably will it be with the new.

Now concrete is a material which lends itself to many kinds of manipulation. It can be cast, pressed, assembled in the shop or on the job. So many are the possible methods of its application—such a diversity of means may be employed toward its legitimate ends—that some of its enthusiastic sponsors see in it a panacea for structural ills and possibly for aesthetic building ills, a substitute for all previously employed building materials—excepting, possibly, door hinges—and a perfect end in itself.

It behooves those who can impartially survey the entire field to offer both warning and encouragement—encouragement in its legitimate use, warning against its too free employment, especially where other materials may better serve the conditions. The economics of the general situation favor concrete, and through this factor alone there may arise a tendency toward its too general employment; toward its substitution for other materials which, though perhaps costing more in mere money satisfy the senses and better fulfil geographic and climatic conditions. The cheapness and ease of casting a flat slab of concrete has led certain enthusiasts to advocate the general adoption of a flat slab type of roof in any and all parts of the country. It is advocated for a northern climate because it can very cheaply be made strong enough to hold a load of snow and ice. But that is not what a roof is for, it is to shed snow and ice. The flat slab roof is advocated for a southern climate because the overhang or shade is so cheaply procured. The shade is desired but not at the expense of ugliness which results from unembellished overhangs—and concrete embellishments are expensive. The factors of ease and economy in manufacturing concrete slabs, whether to be applied vertically or horizontally, contributes to a "simplicity" which tends toward stupidity and to a barrenness which begets ugliness. Where the general form is stupid and ugly not much in the way of reclamation can be effected by proportioning of windows or application of superficial ornament. If the mass is interesting and appropriately conditioned, geographically and climatically, slight defects in details will not too seriously challenge the taste; but an ugly mass is fatal.

In spite of the fact that the learned ones will point out that concrete was a favorite building material with the ancient Romans, and that traces of it are found attaching to Greece, Egypt and the ancient Orient, concrete as employed by modern Americans is a new material, the science and art relating to which are not fully developed.

Much has been done to satisfy the conditions of its employment; much more remains to be done. The newness of an art, or the suspected newness of an art, is a sufficient cause for criticism or antagonism in the average American eye. We are the most conservative people on the face of the earth as regards art and the arts. We will not accept materials and methods on their merits and attempt to develop their intrinsic qualities or worth. Art is about the only line along which we are conservative, however; that is, we conserve very little along material lines—and we do sling dead art about recklessly and embalm its forms in lasting and eternally reinforced concrete in which they appear more

dead than heretofore conceivable. The fact that they are embalmed in a vital and vigorous material emphasizes the fact of death. There are those who claim that these dead forms are alive—but only to the dead do the dead live! Concrete is a vital material full of character—let us give it its vital forms.

Because concrete has for so long been placed into moulds or forms and because of the coarseness of some of its ingredients, one of which was stone which could go through a two-inch ring, the earlier designers (and I fear there were architects among them), being dependent upon precedent, and knowing not where else to look, fell upon the crude Spanish detail and broad masses of the early Spanish Missions as representative of what best might be embalmed in concrete. And so Spanish missions distorted into bungalows and cottages and palaces spread like a rash over the face of the country. As technical and mechanical difficulties were overcome and processes refined the rash itched to take another form of disease and turned into a classic fever, with now and then a touch of Gothic "pains" were noted particularly in the traceries on solids and in voids. The fever still burns, the pains still grip. Expensive forms are built up and destroyed to produce effects which already, ad infinitum, ad nauseam, have been better achieved in stone. However, this is not always to be.

The waste entailed in the destruction of specially constructed and expensive forms has become apparent to many concrete users and exploiters, and their efforts to prevent the consequent loss, especially in case of the smaller residences and the houses with which this Conference is more particularly concerning itself, has introduced an element which may well call for restraint in its application. For the sake of economy forms are reused. When such forms are not perfect in themselves and in utmost good taste, monotony in repetition becomes deadly, and woe to him whom cruel fate has condemned to inhabit a unit in an environment so constituted. Life and joy and self-respect must be absent from the dweller amid such surroundings. Even where the forms are charming and singly in good taste, repetition robs them of individuality and unfits them for occupancy by anyone possessed of character and personality. Individuality of character and personality are absolutely necessary in the units which go to make up to the mass of a civilized and self-respecting society.

Consequently another injunction, which I offer by way of advice, is to avoid wastage of forms—but even more to avoid the monotony which must follow the unrestrained employment of any "motif," ugly or charming. Introduce spice into life in the way of variety. The principle underlying this admonition is just as applicable to a mill town as it is to the most highly developed suburb. In point of fact little or no distinction should be drawn between the mill town and the "swell" suburb. It should exist possibly only in the size of units; it should not exist in the expression of good taste and mental and bodily comfort. Perhaps I am getting ahead of the age and of the present topic. I hope not.

In spite of the manifold and varied means, methods, processes, applications, manipulations—textures, surfaces and colors appertaining to the use and employment of concrete as a medium of architectural

Residence of William A. Boring, New Canaan, Conn. Morrill System forms were used in constructing this substantial home.

A reinforced concrete house at Alton Beach, Florida. The stucco finish provides an exterior wall surface of pleasing appearance.

expression and embodiment, I am not certain that I should advise its sole and unlimited agency in housing the activities of any one neighborhood or community. Indeed I am quite certain that I should not so advise; and this not altogether on the ground of a needed variety, but that there are other materials which transcend even concrete as a medium of certain desired expressions of the human spirit in the art of architecture. And I should desire to see no community curtailed of, or denied, the right and power to express the best that is in it in the materials best adapted to that expression. Thus marble, granite, iron, bronze, brick, slate, each possess inherent qualities or characteristics not translatable into concrete even through the agency of base and artificial imitation. In the matter of brick, for example, there is scale to the unit which relates the mass to human desire and experience in an intimacy possible with no other material, while in natural color and texture the range is boundless. But, even with all that, brick needs other materials in its neighborhood for contrast and variety, purple—green of slate, soft white of stucco, weathered grey of timber, with carvings and turnings; and craftsmanship which cannot be imparted by a mould however exquisitely the surface be wrought by the modeler's hand.

I assume that as an architect I am expected to say that the only way to make concrete an accredited and acceptable building material, adapted to all human and aesthetic needs, is to have its essence filtered through the alembic of the architectural profession, or its representatives. If you wish me to say it, of course I will—with reservations.

Now the most stupid of anachronisms are perpetrated by so-called architects (they really are untutored archaeologists, or rather grave robbers) and the most blatant of modernisms, cut off from all context of history, have emanated from, again, so-called architects (they really are unlettered sentimentalists). But I will say that the possibilities of concrete as a medium of aesthetic expression in building may best be apprehended by a sincere architect, with knowledge of modern social conditions and tendencies, working in cooperation with those who know the material at first hand and who also are sincerely working to exploit nothing, but to develop the latent and inherent possibilities of a worthy material. Such architects exist, such material men exist. They should come together. It should be a function of such conferences as this to bring them together.

I must say one word here as to what should characterize the architect in whom the material man and the public may well place their confidence, being assured that his will be leadership—real leadership and not selfish and autocratic domination. That architect must not exploit any material or system but must be able to recognize, and free to employ the most effective and appropriate under the individual conditions. He must sense the sociological, including social, the ethical and aesthetic tendencies of his time so as to aid his client in the expression of them, curbing wasteful, demoralizing, disintegrating tendencies, and aiding toward social unification; diagnosing present conditions and meeting the situation with skill and clarity of vision rather than in applying formulae learned by routine in the schools. The architect should think in advance of the public and see the goal and the way thereto more clearly. Pity the public which follows, and condemn the architect who pursues the selfish and blind course.

Now, in so far as this paper constitutes a report to be discussed or otherwise, sent to oblivion or laid aside for future reference, which amount to about the same thing, its elements may be summarized and augmented as follows:

IMITATIONS

Concrete has a character of its own; there is no call to torture it into imitations of stone, wood, bronze or other material. Details cast in moulds should bear the plastic touch of the modeler and not the chisel marks of the sculptor.

ECONOMY

Forms suited to the special purpose should be used—forms extravagant of labor and material should be avoided and should be employed only where duplication can be accomplished without monotony.

MONOTONY

Even a good thing ceases to be a good thing when used in excess and two concrete houses from the same forms, placed side by side, is an excess —such treatment is permissible only in barracks where men are in uniform and drilled into the same line of thought, act and movement, all individuality being eliminated.

SLABS

Flat slab roofs may at times and in places be appropriate. A general use would be deadly unless counteracted by features the initial expense of which would more than offset the element of economy which alone would seem to call for a wide prevalence of such roofs.

MONOLITHIC FORMS

This method presents advantages in certain types of structure. The appearance of mass and strength is enhanced by monolithic treatment. Openings and corners can be characteristically and ornamentally treated at slight or no additional expense. Houses pre-cast from monolithic forms and transported as slabs or as units are to be looked upon with suspicion as tending to create types and general monotony. The Committee on Monolithic Houses will have more to say on this subject.

BLOCK

As units. Concrete block laid to be effective as units may perform a legitimate aesthetic as well as structural service. Texture and color can be given them. Their danger lies in exaggerated scale and general uniformity. Stone has the advantage of lending itself to cutting and fitting in length and height without consequent economic waste. The manufacture of concrete block should be studied with variety of size as well as appropriate scale in mind. Corners and angles should be true, and crude and rock faced surfaces avoided.

BLOCK

As backing for stucco. This is a legitimate field for the use of concrete block. Scale need not be taken into account; neither need such matters as sharpness of corners and angles or crudity of surface. Uneven chipping where blocks are cut approximately to the desired outline presents no obstacle to the perfect finish. Surfaces should be such as to which the stucco will most readily adhere.

COSTS AND PERMANENCE

In a letter from an official of the United States Housing Corporation I find these words:

> *"We were satisfied that there were certain types which would produce a good, practical house at a very moderate cost, but it appeared to us that this could be done only where the same unit was repeated indefinitely, and our belief was that this would produce a deadly monotony."*

As to the monotony we have already heard; as to the cost and permanence or durability let me say that there may be cases where permanent houses would be a drawback in a developing community. There would be very little salvage in a wrecked concrete house, while the wrecking would entail almost as much expense as the constructing. Unless a community is well "zoned" buildings of a too permanent nature are an economic waste even though the initial cost may be the same as for a building of less permanent character. Where, as in many of our communities, change is the order of the day, well constructed buildings of a more temporary nature are desirable. Buildings of a temporary nature can be "fire stopped" and made safe for occupancy.

Fireproof Character of Concrete Houses

In the letter above referred to these words appear: "We found that the people who were interested in the concrete house were, almost without exception, trying to build every part of the house in concrete, including porches and all the trim." This would seem to me to indicate a deficient sense of humor on the part of the people referred to, as well as defective vision. I will grant that the designs of many architects who never intended to make a joke of their work are such as to be readily translated into concrete and would not lose in the process; but a concrete man with a sense of fitness, I'll call it humor, would not design to effect the translation. I must still warn the enthusiast against excess—excess of imagination as well as excess in material—or some of them may wish to make the door hinges out of concrete after all! Fireproofness, so to speak, and permanence are good qualities, for which it is possible at times to pay too much.

Methods and Means

How to make the house reasonably fireproof, reasonably durable, reasonably attractive and reasonably economical in cost and in upkeep presents a series of problems for the architect and the concrete expert. As an architect I shall receive the findings of the concrete expert and will make such application of the methods and means presented as may suit the particular case. I will even present the case beforehand to the expert, if it is not already covered, and aid him in his solution. I will even ask him now to present types of floors in structure and finish which are durable, economical, and appropriate to a small house. I will ask the same concerning the roofs, high pitched, low pitched and flat.

There are many problems to be solved in connection with the design, construction and location of the concrete house and I congratulate the concrete and cement interests that they have enlisted the services of so many serious minded and enthusiastic men in the quest for the best along these lines. I hope that architects of vision and deep feeling may be called upon to cooperate.

RELATION OF DESIGN AND PUBLIC TASTE TO THE HOUSING PROBLEM

By Henry K. Holsman, Architect,

President, Illinois Chapter, American Institute of Architects, Chicago

Until recently we had not been impressed by anything like "service" in the cement industry. Neglect of this important requirement in the earlier days of the industry in this country resulted in the appearance all over the country of what is known as the "cement block house." Cement blocks were made of a semidry mixture of portland cement and sand pressed into molds in imitation of rock faced stone or common brick. When this material was forced upon the ultimate consumer in particular and the public in general, it created dissatisfaction because of its ugly, if not repulsive appearance. This complaint must have been loud and insistent, though the most potent objection was probably subconscious.

Nevertheless, manufacturers continued to sell their cement to be used in this manner for a long time. A few years ago a few men here and there, realizing that not what was made, but how it was made, was the cause of dissatisfaction and realizing the real possibilities of portland cement, endeavored to revive the cement block. These men made concrete stone by a proper use and proportion of cement and appropriate aggregates, with the fortunate result that we now have on the market cement block and other cement products that are quite satisfactory from the structural and aesthetic points of view and that fulfill a proper function in the building industry. However, as it is much more difficult to unlearn or discard a bad habit than it is to learn or acquire a good one, I imagine that the cement industry finds that in places it is uphill work to overcome the deep rooted prejudice that the early monstrosities of so-called cement block were responsible for.

When it is realized that nearly everything in the building and construction line can be made of portland cement and that many things that are commonly made of other material can be made better and more economically with portland cement, it is rather remarkable that we are not farther along in the use of this wonderful material than we are at the present time. However, the efforts that are now being made by the cement industry toward educating the consumer in the right ways to use this material will, if continued long enough, supplant old prejudices by developing intelligent appreciation and thereby bring about great benefits to the community and the people at large.

Cement may be considered as fulfilling two chief functions in building. It may be used principally in structural members or it may be used for those other functions about the building that may be just as useful and should be just as durable, and which are more in evidence to the common observer—the protective surface of the exterior, the surface of the floor and partitions. It may be used to good advantage for many things now made exclusively of other materials. For mantel pieces it is

undoubtedly better than wood. In one instance the writer had 42, one-piece portland cement mantels and fireplaces molded and set in place in the building for $17.50 each. These were good to look upon, serviceable, easily washed and kept clean and required no paint. At the same time these were installed, the cost of a wood mantel with brick fireplace and tile facing finished in the ordinary manner, would have cost several times as much and would have been much less serviceable.

Fire-doors are made of wood and covered with metal or made of metal alone, grained and varnished to imitate wood, all at considerable cost, and I venture to predict that fire-doors will be made of reinforced concrete in a manner to serve the purpose just as well as the present types, if not better, and at much less cost.

The products that may be made of portland cement and used in the ordinary building are almost too numerous to mention, and the cement industry can do a great service to itself and the commuity at large if it will continue its wholesale distribution of service.

There is, however, another field in which the industry as well as all other manufacturers of industrial art products could benefit themselves and the general public, and that is in assisting to educate and train industrial art designers, as well as educating and guiding public taste.

European countries long ago realized the fundamental necessity of training in industrial art. The need for educating public taste in our schools and colleges is very apparent in those industrial arts, the products of which are finished at the factory, but I hold that the need is just as great for training in art and public taste in the products which may be made from portland cement, as in those of other materials which ultimately find their way into the fields of art and architecture.

Cement products cannot be successfully and truly sold until they are properly and intelligently designed. It is highly essential that the manufacturer of such products have a proper appreciation of art and an appreciable ability in taste and design. This Conference or some other agency should at once proceed to secure a large number of good designs for small houses and apartments by instituting a competition, offering numerous prizes of generous proportion, and providing for competent judges of well-known standing so that the best designing talent in architecture may be attracted. There is a dearth of good designs of concrete houses of moderate price and economical construction. The results of the competition suggested and the compilation of data that would result from it, should be assembled in suitable form for distribution among, and use by various architects, builders, realtors, housing associations and community plan organizations that may be interested in the solution of our pressing housing problem.

The following principles relating to the design and construction of small houses and apartments should be given consideration:

1. The planning of small houses requires much patient study and as the individual small house owner does not and cannot afford to pay for the best individual architectural services, therefore the design of houses is a matter in which society as a whole and individual communities in particular should interest themselves. They should pro-

vide the funds for scientifically planned, practical, economical, convenient, good looking homes that may be duplicated a number of times without monotony, thereby spreading the cost of plans and designs over a large number of house units.

2. Individual small houses with plenty of yard all around, are preferable. Duplex or double houses or rows of houses of from 4 to 6 units, not to exceed two rooms deep from front to rear, may be tolerated for the sake of economy in land. Planting of shrubs and trees about the house, making the yard practically an outdoor living room and embellishing the street and immediate environment of the house are essential. So-called backyards should be considered things of the past and gardens should be substituted therefor.

3. Home builders should be urged to abandon established extravagant or wasteful customs or prejudices that stand in the way of meeting present-day building problems in an up-to-date logical manner and permitting at the same time attainment of the highest ideals that go to make up the spirit of home in conformity with the growing ideals of our people.

The house should be as small as possible consistent with comfort, convenience and reduction to the minimum of housework. Size and display do not make for happiness. Non-dividend paying or waste spaces should be eliminated and maximum intensive use be adopted. Supplying the needs and convenience of the family should take precedence over complying with the supposed approval of friends or with the supposed ideals of the extravagant rich. The house should have good quality though less quantity. Nothing can be gained by way of comfort, durability or attractiveness from inferior construction. Since the cost of a house of good floor plan and exterior treatment does not increase in proportion to an increase in size of rooms or the scale of the plan, therefore proper space for furniture and the expression of individuality and taste of the owner or occupant should not be sacrificed. Any attempt to press everyone into the choice of the same kind of a house is a serious mistake.

Eliminate excessive overhanging eaves excepting where the particular style of the house, such as flat roof design, demands it. Open porches that can be used only a few months of the year are wasteful and should be reduced to a minimum. Sun porches and sleeping rooms can be used as open porches in the summer and as habitable rooms in the winter. They are preferable to open porches.

Attics should be eliminated wherever possible and basements built under the house for storage and to make it dry and healthful. Ceilings should be cut to the minimum height. There should be plenty of windows for light and ventilation. Ceilings under attics or roofs and also walls should be insulated against cold in winter and heat in summer. Roofs where possible should serve only to shelter from the weather and to provide pleasing variety of color and form to the house.

Since butlers are scarce, if not extinct, butler's pantries should be eliminated. Halls in small houses are out of the question.

Houses should be practically nonburnable and more than one stairway should be considered extravagant or useless.

Since dining rooms as such are not used in excess of one hour a day, they should be replaced by dining alcoves adjacent to living rooms, giving extra space to the living room, if possible, or the kitchens should be reduced to alcoves off the dining rooms, made compact and convenient as combined kitchen and pantry space and capable of being shut off from dining or living room space when not in use. Kitchens as such should be planned with the idea of light and cheery laboratories, providing convenient space for all kitchen work and utensils and storage of materials used therein rather than on the old idea of a room of the house with stove and sink and requiring pantries for the storage of utensils and materials.

The prejudice against hard floors should be overcome and floors be built fireproof with a good attractive, non-absorbent finish, preferably of cement and stone or marble aggregate, capable of being ground smooth and polished.

4. It should always be borne in mind that the planning and building of a home should be an asset to the community as well as to the owner, that badly planned, bad looking, cheaply built houses are a liability both to owner and community. Every betterment in house design and construction reacts upon the community for better citizenship and better government. No country, not even a rich republic, can afford to rebuild its homes every 30 or 50 years. Good design and good taste in the matter of home buildings, home furnishings, home decorations and home uses should be considered a national asset and no pains should be spared to cultivate good taste and teach good design by example and precept to the rising generations.

REMARKS

LESLIE H. ALLEN: I am sure we are all indebted to Mr. Pond and Mr. Holsman for what they have said.

It seems very evident that the use of concrete in house construction has developed almost entirely without the assistance of the architect. As we look at the concrete houses that have been built, it is painfully evident they were not designed by people who had any artistic appreciation of how to use the material in hand. I am certain we shall not succeed in popularizing the concrete house with people in general until we can show them that through the medium of concrete they can be given something really artistic, which conforms to the canons of taste that Mr. Holsman has outlined for us. However, I think we would have to wait too long for the desired end by depending upon a campaign of education in the schools. We should enlist the sympathies and interests of architects throughout the country now and get them to cooperate with us. We engineers should not try alone to perfect good looking designs for concrete houses. As engineers we want to utilize the economies that a concrete house offers to the fullest extent. We are rather disposed to put a flat roof on the concrete house and that is a difficult architectural problem—to build a small box with a flat roof. However, I do not regard it as impossible of solution. Rather, I think it is a challenge to our architectural friends to show us what they can do.

As to the use of concrete block, there are the difficulties encountered in that we have a large unit for a small structure. It is quite a problem architecturally to use such units in a small house even if the surface is acceptable from an artistic standpoint. That is, the difficulty is in getting an effect as pleasing as can be obtained with face-brick. However, it is not an impossible condition to meet but one that needs much more thought and study than it has so far received. When we have secured an artistic result, we have no difficulty in selling it, especially when you consider that now the cost of concrete is such as to compete successfully with the cheapest houses of other types of construction. I think a word of protest should be registered against the sentiments contained in the quotation made by Mr. Pond in which it was stated that it was a mistake to build houses too permanent. We have long been deploring the rapidity with which the frame house depreciates. We have seen many owners of houses fighting to protect their equities that have been wiped out because the structural material has deteriorated so rapidly. Yet there are people today who are advising us not to make a house too permanent because the salvage value cannot be reckoned on if it must be removed or demolished. There are a number of brick houses in many communities that have stood for 50 or more years and are still in use today. There is no reason why there shouldn't be as many and more concrete houses rendering the same or even better account of themselves. There are, of course, conditions when a house must be pulled down to make way for some other improvement. As a rule this is because the value of the land has increased so much as to make a different kind of an investment on the land a better business proposition. In such a case there is no loss. Therefore, I think that some protest is needed against any suggestion that a concrete house is not suitable because it is too substantial.

No separate report is submitted by the Committee on Architecture and Design, but the two preceding papers by Mr. Pond, a member of this Committee, and by Mr. Holsman, are submitted in lieu thereof as expressing the sense of this Committee.

COMMITTEE ON ARCHITECTURE AND DESIGN

Robert Spencer, *Chairman*, Chicago
Melville C. Chatten, Chicago
John Reed Fugard, Chicago
Bernhard C. Greengard, Chicago
Ira W. Hoover, Chicago
George C. Nimmons, Chicago
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HOUSING NEEDS FROM THE VIEWPOINT OF INDUSTRY

By John Glass, Manufacturers Record, Baltimore.

For many years the National Housing Association waged an uphill fight in its efforts to convince us individually and collectively, that there was a housing situation in America crying for a solution. It took the pressure of war on our industries to make us realize that without a home and the advantages that home affords, the worker could not enjoy that contentment which money cannot compensate for and which is necessary to putting one's heart in one's work and making output establish new records. Production and still more production is our need today also.

In establishing its various industrial centers of war activity, the government realized that the foremost need in these centers was to properly house and in other related ways, care for the workers, so that the output desired of them might be realized. Are we in our characteristic American habit going quietly asleep now, allowing these great lessons, learned at so great a cost to be forgotten? I hope not.

Many industries which I might name, and the names of which perhaps immediately come to your minds, have been conspicuous for a number of years in welfare work for their employes. They have realized that fostering a spirit of contentment among their employes, increases the capital stock of good-will which those employes bear to the employer. For that reason much progress has been made in all kinds of social welfare work in industry. A great deal of this has visibly expressed itself in the form of more cleanly, lighter and generally better working environment. Rest rooms and hospital service, recreation features of various kinds, are all developments of industrial betterment from the viewpoint of recognizing and in some way attempting to supply needs as well as diversions which help make the worker more contented.

In our cities we have enacted ordinances, carefully establishing fire limits, rules and regulations relating to kind and structural strength of materials entering into the construction of buildings, insuring that industrial buildings are well lighted, ventilated and as healthful as they can be made. This is good as far as it goes, but after all, it reaches but a small part of the worker's actual life. It does not enter into his living from the aspect of home, because home means more than a mere shelter. It means a place where rest, encouraged by contentment, can throw off the fatigue of the day, where family life can be enjoyed, where the patch of flowers or lawn can be cultivated and enjoyed—in other words, it means a haven of joy and rest.

Those industries which have been foremost in betterment work among their employes, have kept before them continually a progressive program, because past experiences have proven clearly that a human interest in human beings justifies large capitalization. Because our experience is not yet extensive enough to have furnished figures, as well as a multitude of unquestionable authentic facts, we are not able to

The housing development at Morgan Park, Minn., is an excellent example of the successful solution of big housing problems with concrete. Though the result of large scale production, these houses have every appearance of individually built homes.

reduce to dollars and cents the actual profit of any well developed, well wrought out, well executed plans for improving the conditions of industrial workers. We do know, however, how costly the item of labor turnover is. We also know that much of this turnover with its attendant expense and its disorganizing of industry, is due to the fact that at the end of the day, the tired worker, regardless of his status in life, married or single, with or without a family, has no attractive surroundings or no congenial diversions offered away from harmful influences where he can relax and really enjoy the hours off duty.

There are still many industrial concerns in the country, which one would have thought would long ago have recognized that many of their labor and other difficulties were founded on neglect of employes' welfare, and employes in this case means not only the laborer, but those grading upward in employ to perhaps men occupying semi-official or even official rank in the industry with which identified.

A community filled with happy homes is certain to be a community of better moral tone than one less fortunately favored.

In a paper presented by John Molitor before one of the Conferences of the National Housing Association, I find the following:

> "Weakened bodies in large numbers mean weakened will power in the masses, and indicates a large economic waste, which, unchecked, means vice and crime, necessitating elaborate and expensive police forces, courts of justice and penal institutions of various kinds. This waste, mainly attributable to poor housing conditions, is quite in line with our great national waste of natural resources, our forest and city fires and our disregard for the future. As an organized and effective conservation is the only answer to those other wastes, so it is the answer to the great waste of our industrial population, which is the source of the country's real strength. We must profit by the example of other nations and be inspired to make possible the pursuit of happiness for our huge army of struggling toilers. We must recognize the need of economic rather than philanthropic work. We must appreciate the ineffectiveness of our elaborate school system in making good citizens when the influence of the home is diametrically opposed to it. We must recognize the evils incident to slums, and overcrowded, insanitary tenements."

Mr. Molitor in those words has said all that I can say to you. Anything further is merely calling your attention to some of the conspicuous opportunities which the National Conference on Concrete House Construction here gathered has to make a name and fame for itself in helping to provide a solution for our now most pressing national housing situation.

Housing needs today are greater than ever before in the history of this or any other country. The reason for this is evident to all of you. Several years of enforced inactivity in home building, due to the fact that all of the government's man power was being requisitioned to fight a world war, has caused a shortage that threatens to convert the outwardly fine residential section into an inward slum, merely because of overcrowding. That the situation is acute everywhere is indexed in almost every newspaper that one can pick up. A reading of the advertisements for houses or apartments wanted, will show desperation expressed in the form of fancy bonuses offered to anyone who can acquaint the advertiser with how and where suitable living quarters may be obtained. I can conceive of no more nerve-racking strain than to be

without a home, and if we are to retain our present strength as a nation, not to mention increase it, as we should in the natural order of progress, we must find a speedy solution to this pressing national housing condition. Our very industrial existence depends upon it and industrial existence may be made to include the humblest industry of the country, for man vigor is being wasted in the effort to find contentment.

The present problem of labor turnover is being recognized by employers as one of the greatest difficulties they have to contend with. A continually changing force in factory or other business is expensive because the new employe is liable to spoil valuable material or merchandise, it takes him some time to learn his job, during which he produces less than his fellow-workmen. He is likely to damage intricate machinery by his carelessness. The foreman has to spend a good deal of his time teaching him his new job—the time that should be spent managing the whole shop. Clerical work alone of hiring men and paying them off as they leave, and the continual revising payrolls, represent considerable expense and lost motion.

In view of all the unrest with which we have been confronted in the past few months and which is still with us in a great degree, it seems to me that it is up to us to give immediate attention to this pressing housing problem as one of the most inviting fields in which to direct our endeavors. We may thereby eliminate most of the present unrest.

Just how a solution may be effectively contributed to by this conference, I do not presume to advise. There are enough wiser heads than mine here, certain to work out some part of the solution which fortunately can be helped by many precedents that will, no doubt, point a way.

The need for homes is not confined to any part of the country, the small, as well as the large city, needs them. The country needs them, for unrest in various forms has been disclosed on the farms. The farm laborer is no better satisfied with sleeping quarters in the hay mow than the city worker is satisfied with the so-called home in the tenement hallway. We have many classes of people to provide homes for. The unskilled workman, the skilled artisan, the foreman, the superintendent, the executive, the man of relatively little or no means, the man of considerable means, all are out looking for a home or a better home. I am myself.

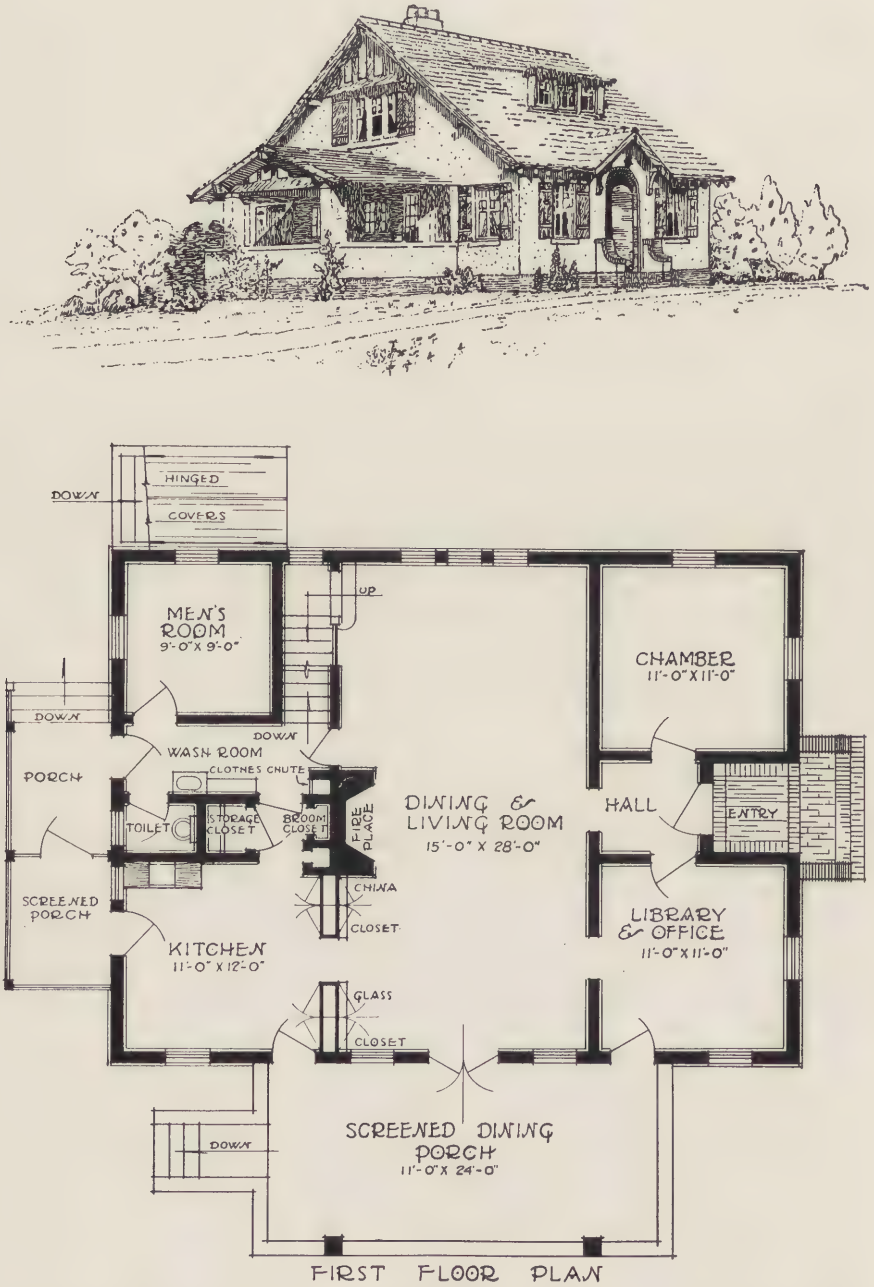
Apartment, or so-called flat accommodations in our large cities are at a premium—they cannot be found. Many of you have realized the difficult of securing even transient hotel accommodations, not only in Chicago, but in other cities where business has called you.

The humblest paid worker, living in the progressive atmosphere of these United States wants a better home now than he would have considered a few years ago. Especially is this true if he has come from the congested centers of some of our European countries. He has become familiar with many of the convenient appointments of American homes and if his means permit, he naturally aspires to enjoying some of these conveniences and appointments.

I have no doubt from the program of this Conference that the various committees reporting to it, are going to offer valuable sugges-

tions as to how we, here assembled, may do credit to ourselves for having been identified with this Conference.

We are face to face with the inter-relation and inter-dependence of all members of society as never before. We realize that this is the time to assist the employe to gratify a sane human desire for more than a shelter, to assist him in every way to secure the same kind of a home that you and I want, and I hope you have. In encouraging and assisting the worker to this end, you have helped to promote in a desirable degree a standard of living that will mean better, more efficient workers, because of environment that conduces to mental, moral and physical growth; and, as I have said before, there is no danger of over-capitalizing any investment that we may make in industrial contentment.



Perspective and floor plan of farm house design awarded first prize in a competition conducted under the auspices of the Illinois State Board of Agriculture and the Illinois Chapter of the American Institute of Architects.

REPORT OF COMMITTEE ON FARM HOUSING

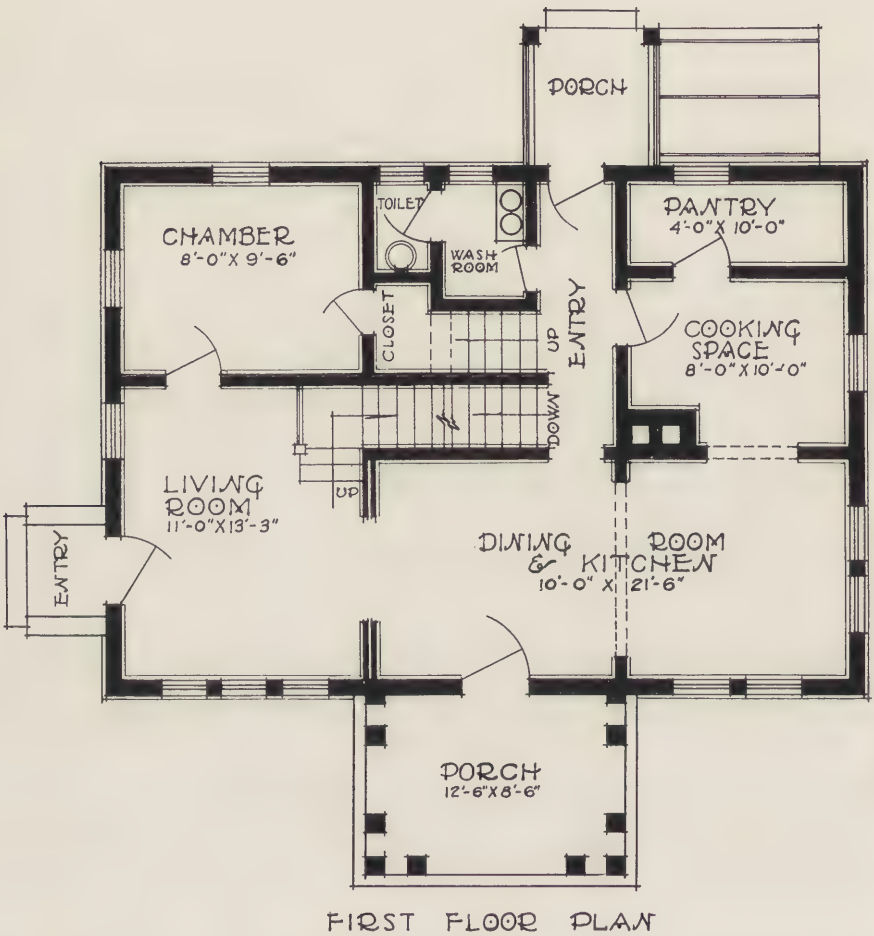
First, the committee desires most seriously to emphasize the fact that the question of farm housing is one of the utmost gravity. It is intimately and fundamentally connected with a basic industry, agriculture. It has been left, in the main, to develop almost automatically, without help or guidance from any source that might be qualified to render material aid or able and intelligent suggestion. It is today a problem that demands immediate and adequate attention if the best interests of our nation are to be conserved.

Recent investigation by federal and state authorities indicate that the spirit of unrest and dissatisfaction so prevalent in other industries, extends also into the agricultural field. It involves directly or indirectly, the farm owner, the farm tenant, and every farm worker. Though there has undoubtedly been improvement in general living conditions on farms, making the comparison from generation to generation, still the change has not been commensurate with that in favorable urban communities. This insufficient development, in connection with other universally disturbing factors, such as unsettled labor and discouraging market conditions, is productive of a spirit of discontent and depression which is becoming increasingly apparent, and which will undoubtedly result in increasingly unfavorable reactions.

As an indication of a condition more or less prevalent in every state, the following quotation from the daily press relative to the situation in the state of New York, is made:

> "Ithaca, N. Y., Feb. 11.—The abandonment of farm life by men and boys during the last year for the city has left more than 24,000 habitable farm houses in the state vacant, according to estimates by Prof. G. F. Warren of Cornell university. His figures were based on a survey of New York farms, which has just been completed by federal and state agricultural authorities.
>
> Prof. Warren said that the figures explained to some extent the scarcity of houses in the cities. The exodus from the farms, he declared, has taken place despite the fact that farm wages will be higher by 14 per cent this year than last. He said the survey indicates that a single man this year will average $52.25 per month in addition to his board, while a married man will receive monthly wage of $68.50, in addition to a house for himself and family and some farm products instead of board."

The fact that housing conditions on many of the farms of the country are notoriously inadequate, undoubtedly is a strong contributory influence in promoting dissatisfaction among our agricultural population. During the war, building operations, except those relating to war industries, were restricted or greatly reduced. Although more than a year has past since the signing of the armistice, there has been no apparent relief from the situation. Unless conditions are remedied, this country will very soon find itself in the same difficult and involved situation which confronts agricultural Europe and which has assumed such proportions as to render it extremely doubtful if a desirable solution can be found without it being attended with grave consequences. All American industries are looking to agriculture to exert that ameliorating influence which might act as oil on troubled waters. No



FIRST FLOOR PLAN

First prize design for a farm house resulting from a competition conducted by the University of Minnesota.

effort should be spared which in any way will contribute to the strength of this influence; agricultural contentment is essential to universal, industrial peace; good home life is the basis of agricultural contentment, and a good home is essential for the enjoyment of good home life.

"In the near future many new farm houses will be built; they should be built so as to include the maximum of desired features. Health and happiness in the home are not marketable commodities, and yet if estimated through a term of years, no one could deny that tangible profits would accrue from an investment in a home which would insure more comfortable living conditions and healthier population. In accordance with human tendencies, the mistakes and triumphs incorporated in the structures of one generation will be transmitted to the next where their influence will be unfavorable, or favorable, as the case may be. The present generation should feel it their duty to build wisely for the future."

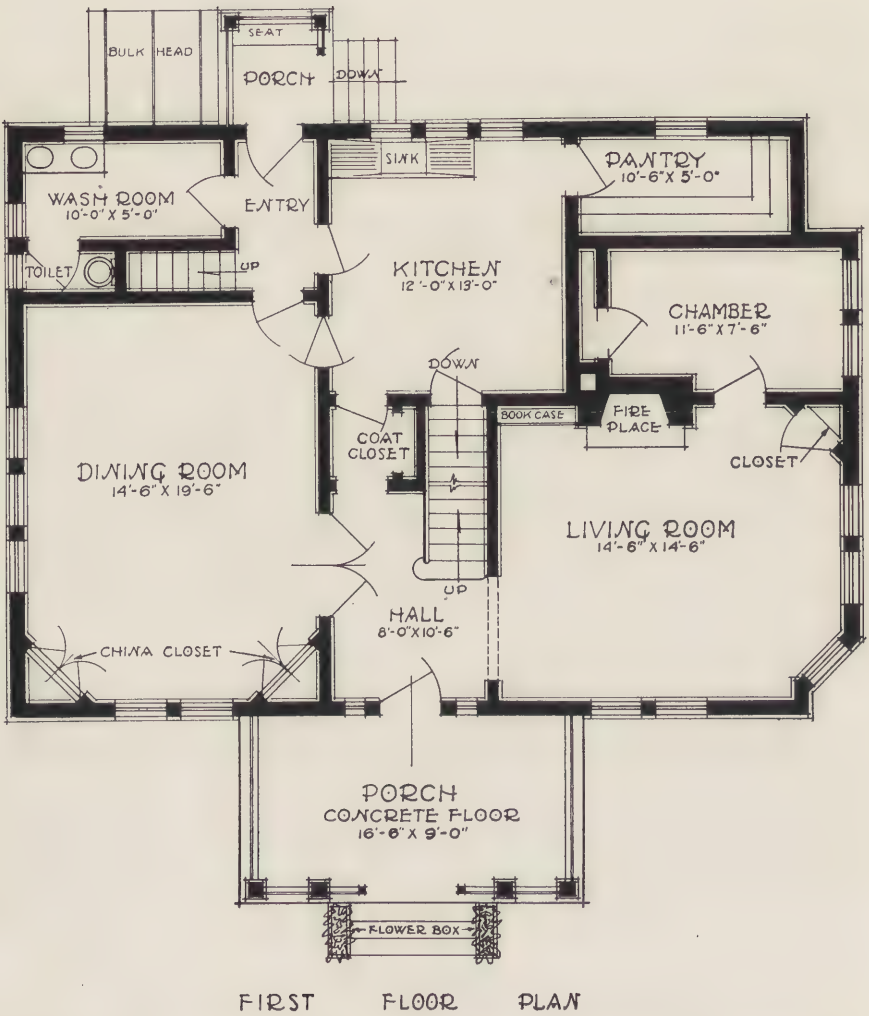
Purposes of the Farm House

The fundamental purposes of the farm house, that of providing shelter and warmth naturally apply to the farm house as well as to a house in any location. Because rural conditions, however, are different from urban or suburban conditions, it may be well to further differentiate the reasons why farm houses are necessary.

1. To provide shelter from the elements and their effects, such as rain, snow, ice, wind, heat, and cold.
2. To furnish protection from animals, vermin, and insects.
3. To provide safe and adequate storage for the various goods and treasures of the family.
4. To provide an administrative center from which the farm operations may be directed.
5. To provide a place in which the social life of the family may be developed and consummated.
6. To make provision for the desirable privacy of the individual and the family.
7. To provide a home.

Economic Minimum for the Farm House

Perhaps the fundamental issues of farm housing can be most readily examined if there be made first a definition as to what should constitute an economic minimum of requirements for the dwelling. It is recognized that promulgation of such a minimum can be made only after a most serious consideration of all the conditions and influences affecting farm life, and that no one minimum can be made which will be universally applicable to all conditions, in all localities. Authorities may also differ as to what constitutes a minimum, and it can be readily conceived that items of such a minimum may change from time to time. This minimum standard should be based on the least household provision at which wholesome living conditions can be maintained from the standpoint of health, labor, care, maintenance, and enjoyment. There are at least



Floor plan of farm residence awarded highest honors in an architectural competition held by the College of Agriculture of the University of Wisconsin.

three viewpoints which should be considered as of major importance in the preparation of the minimum standard. These are:

1. Construction.
2. Arrangement.
3. Equipment.

The period of early settlement when there was pressure to provide shelter for people under any kind of roof, has passed, and we have progressed through several stages of recent housing development until the time is now reached when all manner of building is expensive. It is necessary to examine carefully every point connected with building in order that there be no admission of extravagance at any point. It can be reasonably asserted in the opinions of prominent authorities that the establishment of a housing standard at the present time may be made with fair assurance that it may endure for a comparatively long period of time. Consequently, future needs and possibilities should be given consideration as well as present conditions.

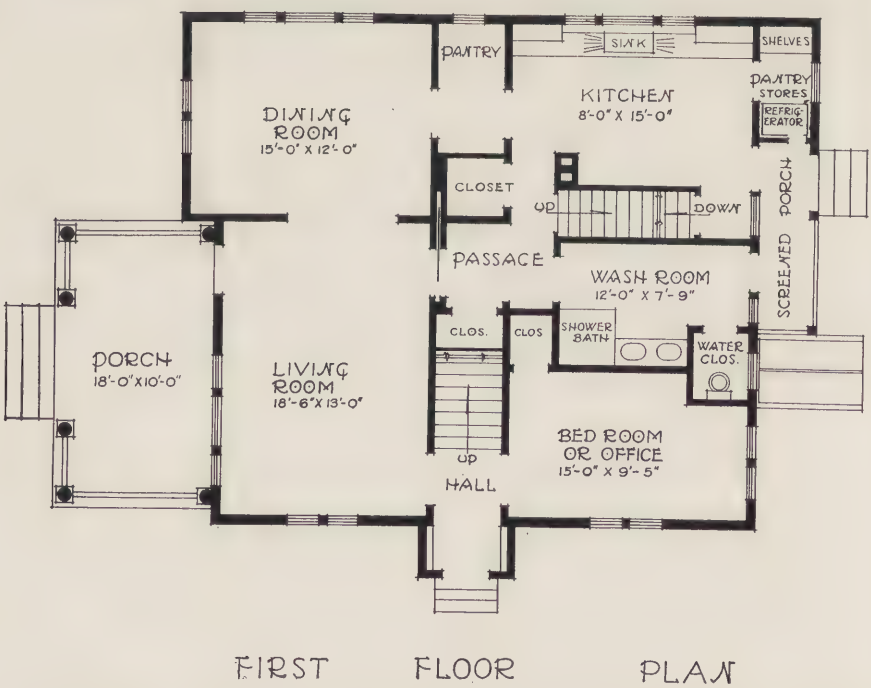
The arrangement of a house is based primarily on its needs. "Broadly speaking, family life makes three demands on a house plan; that it shall provide living area, working area, and sleeping area. It is the function of a good plan to organize these three into a compact arrangement, allowing each requirement an area to itself. Spaciousness must be expressed in the living area, compactness in the working area, and privacy in the sleeping area." The whole arrangement must be made so as to encourage wholesome living.

Conservation of time and energy is obviously one of the problems, the solution of which is necessary for the successful conduct of the household operations. Perhaps the most important way of achieving such conservation is to make use of proper and adequate labor saving equipment. Carefully chosen, the items of equipment will yield return in comfort, economy, and sanitation. It will be true economy to include any item which will enable the physical business of living to be accomplished with fitness and despatch. The more perfectly the home is equipped, the greater opportunity will the spirit have to grow and to express itself.

Minimum Requirements for a Good Farm Residence

1. The material entering into the construction of the building should be reasonably permanent in order that the depreciation and the cost of maintenance be kept as low as possible and that the structure be reasonably safe from destruction by natural causes.
2. Water tight construction in walls and roof.
3. Adequate insulation from cold in order that a reasonable degree of warmth may be maintained within the building.
4. Smooth, tight floors.
5. Light, dry basement in which should be made provision only for storage or for the location of household equipment.
6. Adequate space set off for sleeping purposes, separate bedrooms

The permanent character of this attractive concrete farm residence is emphasized by its concrete tile roof.



The Department of Agricultural Engineering of the University of Ohio found that the floor plan above meets most of the requirements for a farm house in that state.

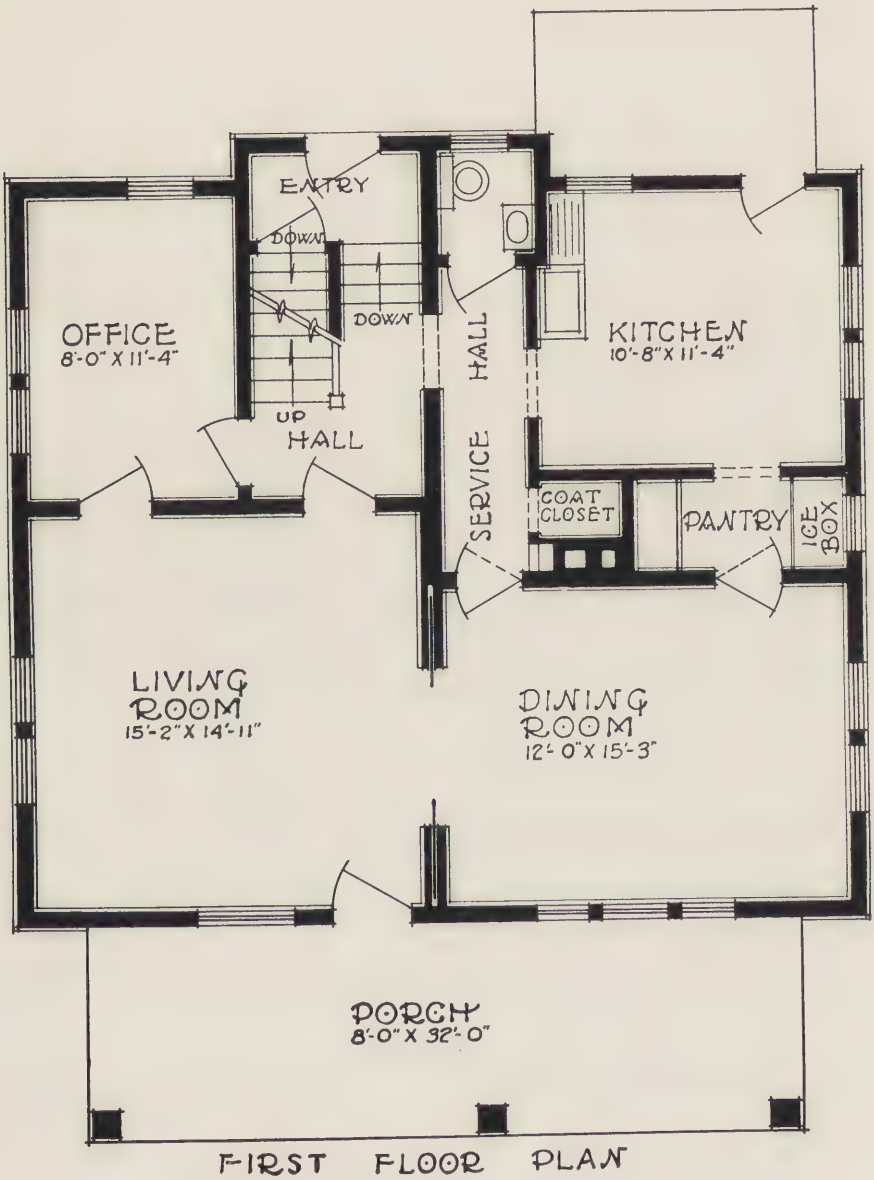
being provided for the use of parents, of male children, and of female children.

7. Every bedroom to have an adequate clothes closet opening from the room.
8. Provision made for culinary operations and for dining purposes.
9. A room in which the family may assemble, and in which social life may be developed. The dining accommodations may be included in this room if desired.
10. Adequate equipment to lessen labor and to simplify the conduct of household operations; this should include heating, lighting and water supply.
11. Adequate sanitation, including lavatory, bath tub and water closet, with proper connection to sewer or septic tank. These fixtures should be included in a separate room.
12. Adequate provision for light and ventilation, with at least one window that may be opened in every room.
13. The house should be made consistently beautiful and attractive.

The various items included in the list immediately preceding may be considered as fundamental requirements which must be included in every farm house of whatever kind or description. Naturally, there are many other features which can be included, and which while not absolutely essential fundamentally, do contribute so much to the worth of a house that the question of their inclusion should be given the most thoughtful consideration. It is recognized that the list which follows cannot be presumed to be complete, and it is inserted for the value it may have as a guide to the one who wants to build something more than a mere structure. It is compiled from various sources including not only federal, state, and commercial bulletins, but the expressions of individuals who have given the matter personal attention.

Desirable Features in Farm House Construction

1. The principal rooms shall have a pleasant outlook, preferably a southerly exposure, the fullest advantage being taken of attractive views, especially toward the highway.
2. An office readily accessible to the driveway and to the barns, for the conduct of the business and the keeping of accounts. This should be available for both the master and the mistress.
3. A guest bedroom.
4. The location of one of the family bedrooms on the first floor to be used in case of illness or accident.
5. The separation of employes' bedrooms from the family sleeping quarters. If both male and female help is employed, the rooms for each should be completely separated.
6. A wash room to be used for laundry purposes, temporary fuel supply, and the storage of such things as coats, overalls, boots, tools, etc. This room should be placed next to the kitchen and



Farm house floor plan designed by the Agricultural Engineering Section of the Iowa Agricultural Experiment Station. It combines desirable features selected from plans submitted in a farm house plan contest.

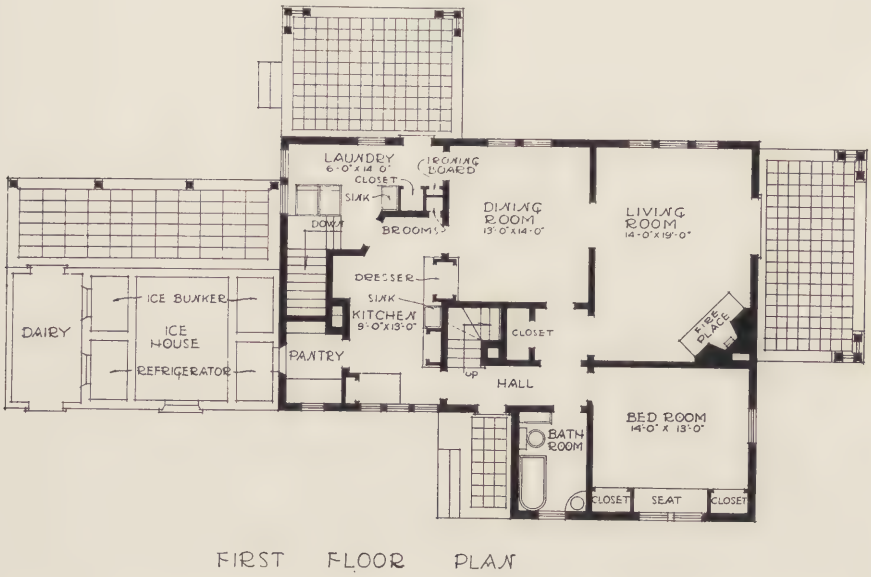
on the direct route between barns and dining room. The function of this room is to act as a sieve between the outdoors and the house and it should be provided with a concrete floor, with drain, and with laundry tubs.

7. A food pantry in connection with the kitchen.
8. Large screened living and dining porches.
9. A fire-place in the living or dining room.
10. Separate bath or shower for the farm help.

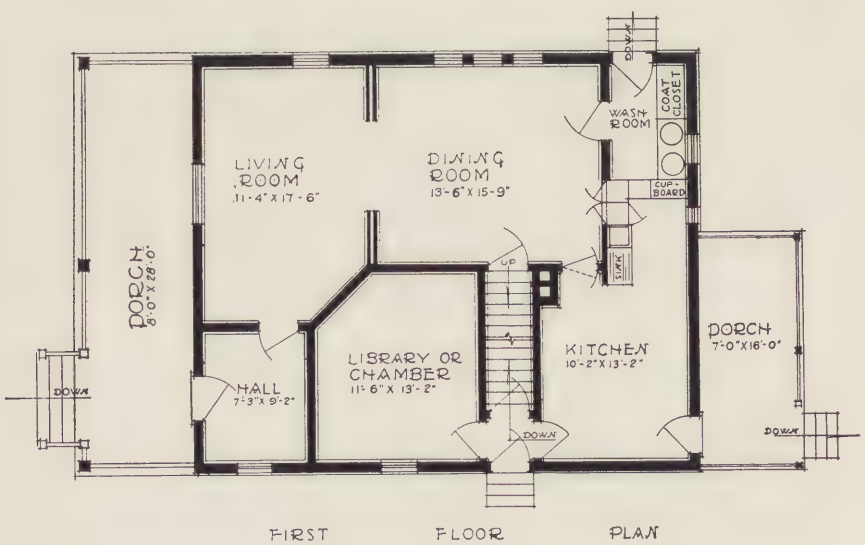
In the preceding discussions no special differentiation has been made between the requirements of the owner's house and the tenant house. Naturally, the investment in the tenant house will not be so extensive as in the owner's and the opportunity for the inclusion of a large number of desirable features will not be so great. Nevertheless, it is imperative that the contentment of the tenant be made a subject of serious consideration and that his quarters be made as comfortable and attractive as consistent with circumstances. The tenant is a human being, and in order to work efficiently, must be housed comfortably. Under ordinary conditions, a simple house is entirely satisfactory, the size depending upon his family. In general, the problem of the tenant house is one, the plans of which includes a general and family room that can be kept orderly, pleasant, and convenient to work in, with one or two rooms adjacent or above for sleeping quarters. The culinary arrangement need not be so elaborate; it should, however, be convenient. The tenant dwelling should be so simple, compact, and good looking that it can compete favorably with the comfort, convenience and attraction of the modern city home, for only in this way can the farm owner appeal to an intelligent type of tenant whose permanence is desired. The testimony of rural communities in which notable houses are provided for farm help indicate that in those communities there existed no labor shortage during the war. An efficient, attractive house is an economic measure for the farmer.

Conclusions

Much has been said and written about the present high cost of building. It is true that a house of a given size today often costs twice as much as one of the same size would have cost twenty-five years ago; but this advance is due not alone to the increased cost of labor and material, but also to the fact that we are not comparing similar types of dwellings. We are comparing a house equipped with heat, running water, hardwood floors, and many closets, and frequently with electric light and built-in furniture, with a mere weather-proof structure built with single floors, no closets, and few or no modern improvements. Many more trades and much more equipment than formerly now go into the building of a comfortable house. It is the amount and kind of equipment that increases the cost; a house thirty by forty feet may be made to cost three thousand dollars or ten thousand dollars, according to the beauty and finish of interior woodwork, floors and walls, the amount of plumbing, the number and kind of fixtures selected, or the kind of heating plant installed. The interest on this



Floor plan for farm house suggested by the Division of Rural Engineering of the U. S. Department of Agriculture.



Arrangement for farm house recommended by Department of Agricultural Engineering, University of Nebraska.

increased investment must be reckoned in distinctly human terms; increased joy of living, greater comfort, finer health and simpler housework for the women, should be sufficient return for any man who loves his home and family.

"Houses stand for not a month nor for a year, but for generations; by them the thrift of a community is judged, by them the ideals and taste of a community are formed. He who deliberately builds an ugly house condemns himself as a poor citizen, while he who builds a beautiful house proves himself a good citizen, for his personal effort contributes to the public welfare." (Helen Binkerd Young.)

OUR IDEAL

"Therefore when we build, let us think that we build forever. Let it not be for present delight, nor for present use alone. Let it be such work as our descendants will thank us for, and let us think as we lay stone on stone that a time is to come when those stones will be held sacred because our hands have touched them and that men will say as they look upon the labor and wrought substance of them, 'See this our fathers did for us.' "—Ruskin.

COMMITTEE ON FARM HOUSING

K. J. T. Ekblaw, *Chairman*, Chicago
W. G. Kaiser, *Secretary*, Chicago
J. B. Davidson, Ames, Iowa
F. W. Ives, Columbus, Ohio
Daniel Scoates, College Station, Texas
J. L. Strahan, Amherst, Mass.
Miss Mabel Sensor, Aberdeen, S. D.
Mrs. Helen B. Young, Ithaca, N. Y.

REMARKS.

PROF. J. B. DAVIDSON: I have two suggestions to offer. First, I would like to remind you that the American farmer is enjoying a greater income than at any time in the history of American agriculture. Of course, we cannot say what his profits are to be in the future, but we hope they will be large. With this increased income there is going to be an increase in the fixed capital of the farmer, who is either going to invest his capital in land or in buildings, and I believe this Conference has an opportunity to encourage him to increase his fixed capital in buildings.

This would be strictly to the interest of the farmer. If he increases his fixed capital in land there is a larger investment without any particular advantage. If he increases his fixed capital in a home, he can enjoy its comforts.

Second, since buildings are costing more, they ought to be built with greater regard for permanence. The larger investment ought to be given the added safeguard of permanent construction. It is also important that we have better design and better engineering in the construction of these buildings.

ROBERT F. HAVLIK: There has been much said about the suit-

ability of concrete floors for dwellings. I would like to relate some of the experiences I have had in Moosehart. There we house hundreds of children. We don't spare expense. We try to give them the very best. We originally started with concrete floors and covered them with a mastic preparation on the supposition that some such covering was needed for warmth and to increase sanitation and resiliency. After a number of experiments, however, we found that the cost of such a floor was higher than for a terrazzo floor. We find that we can put down a terrazzo floor on reinforced concrete for 19 cents a square foot. We also find that the buildings in which we have put this are always clean looking. The more it is walked on the cleaner it gets.

In another building we tried to cheapen the construction and put in a rough wood floor and cover that with an inch and a half of terrazzo covering. This floor is built a little differently from those on top of concrete. We place tar paper on top of the wood floor, which consists of 3-inch ship-lap laid on wood joists, the difference in the floor construction being that the joists are spaced 12 inches on center instead of 16 inches on center as they would be were we to use maple or oak flooring as the finished floor. Reinforcing, which consists of an expanded metal of about 3-inch mesh, is placed on top of tar paper, but not nailed to it. In a few cases we found that where sections met it would be advisable to tack down the reinforcement, such as at a door opening. This floor cost us about 26 cents a square foot, including reinforcing.

We used to cover our concrete floors with linoleum or cork carpet and then in the center of the room used high-priced rugs. But such as we used to buy for $25 are now selling for from $100 to $125, so we cannot afford them. For the last two or three years, wherever we put in a terrazzo floor, we have used it uncovered except in the living room around the tables. In the sleeping rooms we just use the bare floor and there is no complaint by any of our people that it is not satisfactory or that it is cold.

COOPERATION WITH BUILDING & LOAN ASSOCIATIONS IN FINANCING INDIVIDUAL HOMES

By Mark D. Rider
President, United States League of Local Building & Loan Associations, Chicago, Illinois

As we understand it the object of this Conference is to assist in relieving the present housing shortage and unrest. This is a very laudable and patriotic undertaking and worthy of this gathering of representative men of various professions and business institutions, who are able to visualize the ultimate economic saving in the use of materials in character and durability of construction that assure permanency and value of the prospective home.

The financing section of this Conference represented by loaning institutions, mortgage loan bankers and building and loan associations, has been called to assist in arriving at the several ways and means whereby builders may finance such proposed home-building projects and the purchaser or eventual owner liquidate the indebtedness incurred at the lowest possible expense.

Representing Building and Loan Associations, I wish to present a few statistics showing the radius of building and loan operations, size of institutions and the possibilities of extending their service to meet some of the needs presented. Let me quote from the Annual U. S. League of Local Building and Loan Association's 1918-1919 Report, which covers the period of the War Savings Campaigns and which is greatly increased since then. In this compilation the United States is shown to have 7,484 Building and Loan Associations with a membership of 4,011,401 and assets aggregating $1,894,344,346. This is an increase for the year of 215 associations, 172,789 members and $129,202,171 in assets. The average amount due each member is $473.23 as against $460.37, the amount shown last year.

The figure of building and loan assets of about $2,000,000,000 is practically an investment of individually owned homes and represents a mortgage indebtedness of considerably less than 60 per cent of the value of real property.

In the twelve states in which notably increased assets are mentioned, as well as in many other states, the building and loan associations are organized by State authority, and it is through representation of our leagues, that public investment in them is conserved, safeguarded and regulated by special "Building and Loan Laws." In Illinois and many other commonwealths, they are supervised and examined by the Auditor of Public Accounts or Banking, and periodical statements of operation and condition rendered to the public, similar to the supervision of banks.

Notwithstanding the great increase in numbers of associations, membership and size of institutions, the original purpose that gave birth to the "Building and Loan Plan" is still its dominating feature; that is,

These attractive concrete bungalows helped to solve the housing problem in Riverside, Illinois. Walls are of concrete block finished with portland cement stucco, roof of cement asbestos shingles, giving ample protection against the elements and fire.

it represents wage-earners and investors of small savings with a desire to become home-owners, who through its officers seek to assist one another by accumulating their savings and loaning them to each other to buy or build homes on their first mortgage security. Building and loan associations are organized, operated, conducted and managed solely in the interest of their depositors. All earnings of the institution go to the credit of investing members' shares whether borrowed upon or not, every borrower also being an investing member to repay his loan. Adequate credit is extended to the borrower, as from two-thirds to 75 per cent of the value of property mortgaged, may be loaned, to be repaid in installments of interest and principal monthly in amounts slightly more than would be paid as rent for a similar property. There are several amortization plans used by associations but a re-payment plan which does not exceed twelve years is most popular among wage-earners. This provides that approximately 50 cents be paid on principal and 50 cents as interest per month, making a total of $1 per month for every $100 borrowed. These payments are governed by local conditions as to prevailing rates of interest. For example: A loan of $2,000 at 6 per cent would require a monthly payment of $20, which together with accumulations of profit for a period not exceeding twelve years, would liquidate the indebtedness and the home would be paid for and free from incumbrance.

Economy of administration cost is a strong feature of building and loan associations, as demonstrated by the following extracts from the latest auditor's report for Illinois for 1917-18, from which we have taken the following:

"The average earnings of building and loan association shares were about seven per cent, and the average operating expenses or cost of doing business for the fiscal year, less than 7/10 of one per cent of $77,875,897, given as the amount of business done for the year through 662 associations."

These figures prove that the business of building and loan associations is purely cooperative, and that the primary aim is not to seek depositing members in order to be in a position to grant credit for the profit of a few stockholders, but to foster thrift and only to utilize deposits for investment in the interests of depositors.

Financing home building and its relation to the development of the business of contractors and material supply concerns makes building and loan associations essentially interesting to them. The housing needs of the country are a real and serious problem and relatively serious is the financing of such building. Home building is the problem of the individual. Although houses may be constructed in groups, they must eventually be disposed of to the individual and obligations for payment assumed by the individual borrower. Architects, building contractors, and material supply concerns have only been interested in the local building and loan movement to a very nominal extent. I believe, that a wider general understanding of possibilities of working together would be of mutual advantage, as their interests are centered in the same individual,—the home builder. Yet each is dependent on the other. If the prospective home-builders cannot secure loans on terms within their income, they cannot get funds to build with, and neither builders nor supply men will have orders for their commodities. Therefore their extension is of service to:

First: The home-builder, who obtains a loan to build on terms of repayment that make it possible for him to build, and eventuallly at a cost less than commercial interest rates.

Second: Contractors and material houses receive contracts to fill.

Third: The Building and Loan Association, in extending its service to inculcate thrift and home-ownership by securing borrowing and investing members.

Fourth: The community in acquiring taxable invested wealth, and a home-owning self supporting citizen.

The U. S. Department of Labor found the situation sufficiently serious to warrant a complete study of the most practical methods to be recommended in extending necessary credit to wage-earners for building homes. After a thorough investigation of all types of mortgage loan institutions the conclusion was that the U. S. League of Local Building and Loan Associations represented the type of institution best adapted to supply the credit to the average home-builder on the most economical plan, and also, that adequate facilities to accommodate the financing of anticipated building, was at hand in almost every state through the medium of building and loan associations.

As a result of a meeting of leading building and loan representatives called by the Department of Labor, at which it was sought to determine how the building and loan associations of the country might assist in stimulating the building of more homes, a plan was evolved to provide for a system of Federal Building Loan Banks, the details of which are contained in a bill now before Congress. In a general way the bill follows the Federal Loan Act established to meet the financial needs of the owners of farm lands, and the Federal Reserve Act, which provides for the financial requirements of the National and State Banks and trust companies. There is this important difference, however, between Federal Farm Loan Banks and proposed Federal Building-Loan Banks: In the Farm Loan Act there is a provision for the secretary-treasurer to subscribe to the capital stock of the Farm Loan Banks, with funds from the United States Treasury. The capital stock of Federal Building-Loan Banks is to be subscribed for only by the building and loan associations in the several districts, so that not a dollar of the public funds will be required to finance these proposed banks. The building and loan associations will simply be placed in a position where they will be able to help themselves. The Federal Building Loan Banks are to supply the financial needs of the building and loan associations for long-time funds by issuing tax-free bonds against first mortgages on loans deposited with them, 25 per cent in excess of the loan requested. This will make liquid the mortgage assets of these associations and will enable them to provide such additional amounts of money to members for home-building purposes.

We feel that we are justified in requesting for the wage-earners what Congress has already enacted for the farmer and for the business man. At the annual meeting of the United States League of Local Building and Loan Associations, the proposed legislation was considered and very fully discussed by the delegates representing state leagues in various parts of the country, and the convention indorsed and ap-

proved the movement inaugurated by the Department of Labor, which resulted in the introduction of S. 2492 and H. R. 7597, known as the Calder-Nolan Bill now before Congress.

We feel warranted in saying that the building and loan associations of the United States can, through the medium of a bill like this, if enacted, be successfully employed in relieving much of the shortage which now exists for funds for home building purposes.

Cooperation with the business people of every community should be the aim of the Building and Loan Associations to broaden their sphere and growth and enable them to become the acknowledged national home-building financing medium.

REMARKS.

K. V. HAYMAKER: You are not interested in Building & Loan Associations as an institution unless the institution comes to you and helps you in your business. I want to tell you how they can be of efficient aid to you.

This building proposition finally resolves itself into one of finance—where is the money coming from that is going to pay for buildings that must be supplied to the country? The building program looms larger than it ever did before, and at the same time the amount of money available to finance it is being seriously curtailed. There is just one type of financial institution in this country that devotes all of its resources and confines all of its activities to building homes, and that is the Building & Loan Association. Mortgages are taken by other institutions like state banks and savings banks and trust companies, but they are not going to invest in that kind of securities to the same extent in the future as they have in the past for this reason.

The Federal Reserve banking system has been organized to handle short-time credits, that is the kind of paper on which the commercial and industrial and transportation business of the country is conducted. When the Federal Reserve Bank was first organized, the plan was that it should affiliate only with the national banks of the country, but in the few short years that have passed since the Federal Reserve Act went into effect, it has been demonstrated that the resources of the national banks of the country are not sufficient to finance the country's business. As a result, there is today a well-defined movement being carried out quite extensively to induce state banks, trust companies and savings banks to affiliate with the Federal Reserve system. The reason for this is that it gives such institutions the opportunity to rediscount their short-time commercial paper with the Federal Reserve Bank.

Today, I think that "call money" is worth on the New York market from 16 to 25 per cent. Why should a bank invest its money in long-time 6 per cent mortgages when it can lend it at the Stock Exchange at 25 per cent?

This affiliating with the Federal Reserve banking system gives these other banking institutions an opportunity to handle commercial paper in larger volume because they can rediscount it with the Federal Reserve Bank and they cannot rediscount mortgages because they represent long-

time paper, which the Federal Reserve Bank will not accept as collateral for loans. For that reason, as these institutions go into the short-time credit business, they will to that extent curtail their investments in mortgages and very serious curtailment will follow in the amount of money which those institutions will invest in any long-time mortgages.

Emphasis has been laid upon the necessity for some plan by which the gap could be bridged between the amount that can be raised on the first mortgage and the amount of money which the home buyer or builder has at his command to invest in the home, and the limit has been fixed that the home buyer or builder should have at least a 10 per cent equity before he can negotiate a loan or finance his building. A 10 per cent equity is small, yet we sometimes hear it suggested that the great need for home building should be satisfied by furnishing a man a home and letting him pay for the whole transaction on installments. Do you know of any business that a man can go into without money or credit? Do you know where he can start a shoe shining parlor or peanut stand without money or credit? I don't. Then why should we expect a man to be able to buy a home without money or credit? A man who has proved by his thriftiness that he has the ability to save money, has earned the right to credit, but his saving should be at least 10 per cent of the proposed investment.

In financing home building, I believe that a safe risk on a first mortgage is higher than 60 per cent to a man of good character, with a steady job and a fair income. I believe that 75 or 80 per cent credit is absolutely safe with a man of that character providing the property in question is suited to his condition in life and of a value where the mortgage burden of monthly payments is within his income. In New Jersey the law limits the amount of money which a building association can loan to 80 per cent of the compressed value.

Here is a suggestion by which a combination of finance companies and building and loan associations can finance the entire loan:

A home financing company or house building company is organized for the purpose of stimulating home building. That is just the line of work a building and loan association is doing. If they take the capital which they gather and invest it, that is, just deposit it in the building and loan association, they know that it will be used for the purpose of financing home building. Suppose this finance corporation has deposited $50,000 in the building and loan association. Along comes a man who wants to buy a home who has 10 per cent. The building association wanting to safely invest the small earings of its depositors and taking good care that they shall be safely invested, says: "We will lend him 60 per cent." The housing corporation comes in and says, "We have $50,000." That makes 30 per cent, so on a thousand dollar home that means $300 of a margin that has to be bridged—a gap that must be filled. We will take $1,200 of this stock in your building association and sign it to the building and loan association as collateral for this borrower's loan. You make him the loan to the full 90 per cent and we will put up as collateral the $1,200. As a result, at each settlement with the building association which it makes with the borrower, the building corporation which has put up the collateral, is permitted to take down

that portion of it hypothecated on his debt in excess of the interest. That is repeated with each individual that comes along to borrow. In that way the housing corporation can finance the building of homes without any more risk than they are taking on the plan suggested. They are helping the building and loan association, they have an investment that is drawing dividends at the regular dividend rate paid by the association as long as their money is invested and it is only when the borrower falls down that they are compelled to come in and assume that mortgage or find another borrower for the property and protect their investment.

Just another suggestion. While you are building homes you have more or less influence over the type of house you are building. See that the houses are built right. Get away from the square box-car type—the shanty. Encourage people who are borrowing money and building homes to make them habitable, neat, attractive and possessed of the conveniences of life.

In most cases the profit of the financing corporations operating as I have suggested is limited to the dividends which are paid on the stock that they put up as collateral. It is done usually as an accommodation. Sometimes they insist on a bonus from the borrower that has taken out a part of the loan and paid to the corporation something on the principle suggested by Mr. Allen, where they use a service charge of $300 per house, or something of that order.

It is unfortunate that building and loan associations have the word "building" in their name. It is a relic of bygone days, since they do not do any building. More nearly correct designation would be to call them "Savings and Loan Associations," for that is what they really encourage and do.

VARIOUS PLANS FOR FINANCING PERMANENT HOMES

PENNSYLVANIA STATE CHAMBER OF COMMERCE HOUSING BUREAU

Plan Number One

Community Companies

1. *Capitalization.*—The capital funds of the Financing Company to be raised by public sale of certificates of stock. Subscriptions to be made by individuals, estates, commercial and industrial interests. Fifty per cent of the authorized capital to be subscribed immediately and to be subject to call on reasonable notice.

2. *First Mortgage.*—The home seeker to place a first mortgage with an individual, estate or lending institution. The Financing Company to approve and assist in placing the mortgage. The mortgage to be for an amount equal to at least 60 per cent of the total cost of the home, including the improved lot.

3. *Second Mortgage.*—A second mortgage to be assumed by the Financing Company for an amount not in excess of 30 per cent of the total cost of the home including the improved lot.

4. *Initial Payment.*—The home seeker applying for the loan to have in cash, land or its equivalent an amount not less than 10 per cent of the total cost of the home, including the improved lot. This payment to be made to the Financing Company at the time the loan is negotiated.

5. *Liquidation.*—Monthly installment payments in amount not less than 1 per cent of the total cost of the home, including the improved lot, to be made to the Financing Company by the home seeker to meet the interest charges, to retire the second mortgage and eventually to retire the first mortgage.

6. *Revolving Fund.*—The release of the Financing Company funds due to the retirement of the second mortgage by the installment payments to be available for re-investment.

7. *Income.*—The gross income is estimated to be 6 per cent. of the invested capital. After deduction of expenses, such as salaries, office rent, etc., the net income of the Financing Company is estimated to be from 4 to 5 per cent if the capital is fully invested.

Plan Number Two

Community Companies

1. *Capitalization.*—The capital funds of the Financing Company to be raised by subscription by commercial and industrial interests. Fifty per cent of the authorized capital to be subscribed immediately and to be subject to payment in specific amounts at certain definite periodic intervals.

2. *First Mortgage.*—The Financing Company to assume at the prevailing interest rate a first mortgage equal in amount to not less than 60 per cent of the total cost of the home, including the improved lot.

3. *Second Mortgage.*—The Financing Company to assume at the prevailing interest rate a second mortgage equal in amount to not more than 30 per cent of the total cost of the home, including the improved lot.

4. *Initial Payment.*—The home seeker applying for the loan to have in cash, land or its equivalent an amount not less than 10 per cent of the total cost of the home, including the improved lot. This payment to be made to the Financing Company at the time the loan is negotiated.

5. *Liquidation.*—Installment payments to be made monthly by the home builder at a rate of not less than 1 per cent of the amount advanced. The payments to begin when the loan is made.

6. *Revolving Fund.*—The Financing Company to sell trust notes to in-

vestors, pledging the mortgages as collateral, thus constantly securing additional funds of increasing effectiveness for re-investment.

7. *Income.*—The net income will depend largely upon the rapidity of re-investing the Financing Company's funds. It is estimated not to exceed 6 per centum of the invested capital.

PLAN NUMBER THREE

COMMUNITY COMPANIES

1. *Capitalization.*—The capital funds of the Financing Company to be raised as described in Plan No. 1, Certificates of paid up stock in one or more approved building and loan associations to be purchased as fast as the capital funds are received.

2. *First Mortgage.*—The home seeker, with the assistance of the Financing Company, to place a first mortgage with a building and loan association in which the Financing Company holds stock certificates. The amount of this mortgage to be not less than 60 per cent of the total funds required.

3. *Second Mortgage.*—The second mortgage as such does not enter into this plan but appears in different form. In case the building and loan association is prevented from assuming the degree of risk represented by the difference between the amount of the initial payment of the home seeker and the total loan, then the Financing Company will assign to the building and loan association certificates of paid up stock of the building and loan association held by the Financing Company. The amount of this assignment to equal the difference between the loan assumed by the building and loan association and the sum required by the home seeker.

4. *Initial Payment.*—The applicant to make an initial payment to the building and loan association at the time the loan is negotiated. This payment to be not less than 10 per cent of the total cost of the home and improved lot.

5. *Liquidation.*—The home seeker to make monthly installment payments to the building and loan association in amount equal to not less than 1 per cent of the funds advanced. A portion of these payments to apply against the interest charges and the balance to release the paid up certificates assigned to the building and loan association by the Financing Company.

6. *Revolving Fund.*—The Financing Company funds to be released for re-investment by applying the installment payments against the certificates of paid up stock held by the Financing Company. As these certificates of paid up stock are released they become immediately available for furthering new loans.

7. *Income.*—The gross income of the Financing Company will amount to the rate of interest paid by the building and loan association on the paid up certificates of stock.

PLAN NUMBER FOUR

COMMUNITY COMPANIES

1. *Capitalization.*—The capital funds of the Financing Company to be raised by public sale of certificates of stock at a par value not to exceed $100. Subscriptions to be made by individuals, estates, commercial and industrial interests. Ten per cent of the total amount subscribed to be paid at the time of subscription and the balance in periodic installments.

2. *First Mortgage.*—The home seeker to place a first mortgage equal to not less than 60 per cent. of the total funds required, with any one of a number of lending institutions approved and recommended by the Financing Company.

3. *Second Mortgage.*—The Financing Company to take as collateral a land contract to cover the amount required to bridge over the difference between the first mortgage plus the initial payment and the total loan. In this plan the home seeker is required to purchase a lot on his own terms.

4. *Initial Payment.*—The home seeker to hold as equity in a lot an amount equal to at least 10 per cent of the total funds to be advanced.

5. *Liquidation.*—The home seeker to pay to the Financing Company each month an amount equal to not less than 1 per cent. of the cost of the house. These payments to retire the loan advanced by the Financing Company, at which time the land contract will be terminated and the home builder given a deed to the property. In addition the borrower is also required to meet the interest charges of the first mortgage, to pay the taxes and to carry fire insurance.

6. *Revolving Fund.*—The Financing Company to secure funds for re-investment by negotiating loans and offering the land contracts as security.

7. *Income.*—The estimated gross income with the capital fully invested to be 5 to 6 per cent per annum.

PLAN NUMBER FIVE

INDUSTRIAL COMPANIES (No. 1)

1. *Capitalization.*—Capital funds to be appropriated by the company or com panies entering into the housing project.

2. *First Mortgage.*—In lieu of a first mortgage a demand note at the current rate of interest is given by the employe to the company for the customary first mortgage amount.

3. *Second Mortgage.*—In lieu of a second mortgage the employe gives a time note to the company. This time note to be payable after a number of years at the current rate of interest. For example, a $1,000 note payable in 12 years with interest at 5 per cent.

4. *Initial Payment.*—The employe is required to make a payment of not less than 10 per cent of the total cost of the house, including the improved lot at the time the loan is negotiated.

5. *Liquidation.*—The employe agrees to purchase the requisite number of shares in a building and loan association or other approved lending institution upon which periodic installment payments are made so that the deposits at the current rate of interest will have matured in a sum equal to the face value of the time note at the date set for payment of the time note. The employe also agrees to carry the loan by making monthly interest payments to the company on the demand and time notes. The company agrees not to act upon the demand note as long as the employe continues to fulfill his part of the agreement; that is, to make monthly interest payments to the company and monthly payments to the lending institution.

6. *Insurance Benefit.*—If the employe should die or become incapacitated within the payment time of the time note, provided that in the event of death the employe is not over sixty years of age, the company will accept the cash surrender value of the shares of the lending institution as full payment of the time note. The property will then be free from all incumbrances except the amount of the demand note, which, at the option of the employe or his heirs, may be transferred as a first mortgage to a lending institution.

PLAN NUMBER SIX

INDUSTRIAL COMPANIES (No. 2)

1. *Capitalization.*—Capital funds to be provided by the company or companies interested.

2. *First Mortgage.*—The company will assist the employe in placing a first mortgage with a lending institution to cover at least 60 per cent of the total funds required.

3. *Second Mortgage.*—In lieu of a second mortgage a time note is given by the employe to the company for an amount equal to the difference between the first mortgage plus the initial payment and the total funds required.

4. *Initial Payment.*—The employe is required to make a payment of not less than 10 per cent of the total cost of the home, including the improved lot at the time the loan is negotiated.

5. *Liquidation.*—The employe agrees to purchase a combination "life-accident" insurance policy and to maintain same in force until paid up, at which time the cash surrender value will be used to liquidate the time note and possibly a portion of the demand note. The employe is required to make monthly interest payments to the lending institution and to pay taxes and carry fire insurance.

6. *Insurance Benefit.*—In the event of death of the employe or injury to the extent of causing partial or total disability the compensation paid by the insurance company will be available to pay off the time note and possibly a portion of the demand note. The property will then be free of all incumbrances except the first mortgage.

THE CHICAGO PLAN

The Chicago Housing Association has worked out an idea new to realty. This idea leads to the Americanization of the foreign workmen and at the same time to a solution of the city's housing problem. In large, manufacturing and industrial centers, these two elements go hand in hand. To make the idea effective, the management is cooperating with the social service and welfare departments of a number of industries, especially those of the stock yards, in which area the housing problem of Chicago is at its worst. Workmen will be encouraged to apply for a new house, but will not be allowed to purchase a place unless his present quarters are unfit for family life. Reports on the present living conditions will be made by expert investigators. If the report is satisfactory, that is if the living conditions are unsatisfactory, a contract will be drawn and the house sold on the basis of a 10 per cent initial payment; the balance to be paid off in monthly installments extending over 15 years.

As a part of the consideration for selling these houses so cheaply (practically giving the valuable lot on which the house stands) the buyer agrees not to resell the property except by the permission of the seller. If a man changes his employment and desires to move from Chicago, the Association has the first option on the property, being privileged to return to him the money paid and to resell to another party found eligible under the above conditions. Speculation will thus be prevented and the benefit of increased value bestowed upon the persistent man who sticks to his determination to become a home owner. To make sure that each family shall have a home in the event of the death of the bread winner an insurance policy low in cost and with decreasing premium is secured for each buyer. Part of each monthly installment paid will apply on the insurance premium and in event of death the property is immediately deeded to the heirs.

THE INDIAN HILL COMPANY PLAN

Worcester, Mass.

The Indian Hill Co. require from the purchaser of a home an initial payment of 10 per cent of the purchase price whereupon the conveyance of the property is made. For the remainder of the purchase price, the purchaser gives two notes, one for $1,000 payable in 12 years at 5 per cent and the other for the balance of the purchase price payable on demand with interest at 5 per cent, both notes being secured by a purchase mortgage.

The purchaser also gives a supplementary agreement to the effect that he will purchase five shares in a cooperative bank, continuing payment therein until his deposits shall have matured in the sum of $1,000, which in local banks, at the prevailing rate of interest, takes place in about 12 years. This insures the payment of the 12 year note according to its terms. It gives the purchaser a feeling of independence inasmuch as he does not make periodical payments on the principal to the company and also enables him to become familiar with cooperative bank methods.

In consideration of the buyer's agreement, the company agrees not to call the demand note as long as the purchaser continues to make monthly payments in accordance with his agreement to the cooperative bank. The company further agrees that if he should die or become incapacitated within 12 years, providing that at the time of his death he shall not be over 60 years of age.

they will accept the surrender of his cooperative bank shares in full payment of the time note. The result of this agreement is that the purchaser may be assured that at the end of 12 years or upon his death a sufficient proportion of the purchase price will have been paid so that he or the heirs of his estate will then have an equity in the property of practically 40 per cent. At his option he may resort to a bank for a mortgage and be entirely independent of the company.

The company gives to the purchaser a schedule showing the required monthly payments. The following table is a reproduction of one which was given to a purchaser and illustrates this method of financing:

Total purchase price	$3,851.50
First payment, 10 per cent	385.15
Borrowed on mortgage the balance	3,466.35
Amount due in 12 years secured by time note	1,000.00
The balance secured by demand note	2,466.35
Monthly interest during first 12 years	14.45
Monthly payment to cooperative bank	5.00
Total payment during first 12 years	19.45
Monthly interest payment after 12 years	10.30

THE GOODYEAR RUBBER CO. PLAN

Akron, Ohio

The Goodyear Co. in their housing work at Akron plan to place two mortgages on the property, the first for about one-half the valuation of the property carried by an insurance company and the second for the balance carried by the Goodyear Co. It is not necessary to make any payment down when the property is purchased. Payments are made semi-monthly, which takes care of the second mortgage in 12 years and the first mortgage three years later, the rate of interest being 6 per cent per annum. These periods are the maximum time allowed to pay for the property, but provision is made to allow extra payments to be made if desired as well as preliminary payments down. The purchaser has the option of taking a diminishing life insurance policy with an insurance company which in case of death will pay one or both of the mortgages depending upon the amount of insurance taken. The insurance company have made an attractive group insurance proposition which brings the cost of this feature to a very low figure and has made the purchasing plan very popular.

PLANS ADOPTED BY HOUSING COMMITTEE OF HARTFORD CHAMBER OF COMMERCE, DECEMBER 29, 1919, FOR MEETING HOUSING NEEDS IN HARTFORD.

Stockholders are to consist solely of employers, employing over 25 employees. Each employer to subscribe for not more than $75 of capital stock per employee.

The activities of the corporation are to follow two distinct lines in providing housing accommodations: 1. By assisting employees in building houses on their own account and in accordance with their own plans. 2. By building houses on separate lots in various parts of the city to be sold to employees.

In assisting employees in the construction of houses on their own account the corporation will furnish the employee advice and help in purchasing a lot and in the preparation of plans. The corporation will employ a competent architect or builder to assist in letting contract, supervise building construction, and to protect owner. Corporation to advance required payment to contractor, taking as security for such advancement a temporary mortgage from owner of lot at 6 per cent interest. Building materials to be purchased at wholesale by corporation and supplied to contractor at cost.

Financial assistance after completion of building will be given employees, by securing first mortgage on the completed house from bank or insurance company at lowest price possible and advancing balance of cost on second mortgage at 6 per cent interest, less 10 per cent of total cost, which amount is to be

paid by employee. Buyer to pay at least 9/10 of 1 per cent of total cost to corporation monthly to cover payment of taxes, assessments, insurance, interest and reduction of second mortgage until second mortgage is paid in full.

As an alternative method of assisting employees the corporation will take title to lot on request of employee, build a house thereon as desired by employee and when completed re-deed to employee at cost with interest at 6 per cent on all advancements from date of same to date of reconveyance to employee; payment to be made in same manner as above.

Activity of corporation for building houses for sale will include purchase of lots in various parts of the city within convenient distance of plants of stockholders and erect two-family houses at a total cost of lot and building not exceeding $8,000 each; and shall secure a mortgage on them for 50 per cent of total cost and shall then sell them to employees of stockholders at reasonable market value. Method of payments is the same as described above.

FLINT HOUSING CORPORATION

The plan of action proposed by the Flint Housing Corporation is to acquire vacant property in the localities where homes are the most needed, building thereon and continuing as the funds permit.

The specific aims will be to construct homes at a low cost for those who would not be able to secure them through ordinary commercial channels. The homes will be sold on an initial payment as low as 10 per cent and a further payment of 1 per cent per month. The title to all property acquired will remain in the corporation until such time as a sufficient amount has been paid to warrant the issuance of a deed.

HOUSE FINANCING CORPORATION OF DETROIT

The method of apportioning the stock subscriptions on a fair and equitable basis adopted and found satisfactory is as follows: The manufacturer or business man subscribes on the basis of the number of men and women employed:

The first 500 or any part, at $25 per employee.

The next 501 to 1,000 at $20 per employee.

The next 1,001 to 5,000 at $15 per employee.

The next 5,001 to 20,000 at $12.50 per employee.

The next over 20,000 at $10.00 per employee.

The method of operation adopted includes three general classes of business, known as: 1. The Banking Plan. 2. The Operation Plan. 3. The Contractor's Financing Plan.

The banking plan takes care of those applicants who own their own lots or have in mind the purchase of a certain lot in some specific locality. The corporation loans up to about 80 per cent of the total amount involved in the transaction as represented by the combined appraised value of lot and cost of the home, whereas banks and trust companies loan up to only 50 per cent of the improved property. The corporation assumes the entire financing, planning, directing and inspection of the operation to the point where the client is notified that his house is ready for occupancy. The client pays for expenses incurred at the rate of $67.50 per thousand dollars on the cost of the completed house.

The corporation arranges for the payment of same by the client within the first year and the amount of payment is covered either in a separate note payable in monthly installments, which sum is in addition to the regular contract monthly payment against capital and interest, or in cash at time of signing contract.

In the Operation Plan adopted to get more houses erected more quickly, the corporation purchases a number of lots en bloc, located in the various sections of the city contiguous to manufacturing plants and transportation facilities. Upon each block of lots the corporation erects groups of houses simultaneously to secure every advantage gained in quantity production. The selling plans are similar to those previously outlined under the banking plan, although smaller monthly payments are required.

Individuality as well as permanence is secured with concrete construction; no two houses of this type need be alike. Above, a street of stucco finished concrete block houses at Indianapolis. Below, exposed aggregate, concrete block residence at Park Ridge, Ills.

REPORT OF COMMITTEE ON FINANCING PERMANENT HOMES

I—FEDERAL LEGISLATION

Need for Legislative Action

Everywhere is evidence that an acute housing shortage is adding to the present social unrest. Continued neglect of a definite policy on part of the government to encourage home construction threatens to impair the welfare of our nation. According to careful surveys there is at present a need for at least one million new homes in the United States. Proper housing will do much to stabilize labor conditions, increase plant efficiency and materially increase production. During the war it was necessary for the protection of our national security to curtail building; today it is deemed equally necessary to resume construction work in order to safeguard our national integrity, and it is urged that everything possible be done to encourage the construction of suitable homes. Since the signing of the Armistice, housing conditions generally throughout the country have failed to improve; instead, there is evidence that the housing shortage has gradually become more and more acute.

Home construction has been further curtailed because of the necessity of providing capital upon short term loans to tide industries over the reconstruction period, diverting capital from long term loans based on real estate mortgages. A careful and comprehensive study should be made by Congress of the sources of capital available for building, giving consideration to the advisability of creating beneficial legislation.

The Canadian government has provided for a loan of $25,000,000 at 5 per cent to the Provincial governments for housing purposes. The object is: (a) to promote the erection of dwelling houses of modern character to relieve congestion of population in cities and towns; (b) to put within the reach of all working men, particularly returned soldiers, the opportunity of acquiring their own homes at actual cost of the building and land secured at a fair value, thus eliminating the profits of the speculator; (c) to contribute to the general health and well being of the community by encouraging suitable town-planning and housing schemes.

The British Government has a somewhat similar scheme, but neither of these has produced very good results owing to the restrictions and red tape connected with their application. It is important that any scheme enacted by the Federal Government should be flexible enough to adjust itself to the rapidly fluctuating cost of material and labor and should be simple enough to be applied without a large amount of government restriction and regulation. It is probable that similar power placed in the hands of states and municipalities would produce better and quicker results.

PENDING LEGISLATION

The building and loan associations that have consistently encouraged saving for the purpose of home building hold time mortgages on real estate valued at approximately $2,000,000,000 and now find themselves with insufficient funds for home buying and home building because their only source of working capital is derived from weekly cash deposits paid in by the association members.

To relieve these conditions the "Federal Building Loan Act" has been introduced in Congress by Senator Calder (New York) and Representative Nolan (California) through bills, S 2492 and H R 7597 entitled "A Bill to Encourage Home Ownership and to Stimulate the Buying and Building of Homes; to Create a Standard Form of Investment based on Building Association Mortgages; to Create Government Depositories and Financial Agents for the United States; to Furnish a Market for Government Bonds; and for Other Purposes." These bills would create a system of Federal Building loan banks operating under the general supervision of the Treasury Department and make available, for the purpose of dwelling construction, a considerable portion of the two billion dollars now tied up in the mortgages held by the building and loan associations throughout the country. Another bill with almost identical aim has been introduced in the House by Representative Hill, known as the "FEDERAL URBAN MORTGAGE BANK ACT" (H. R. 10518).

Recognizing the need for more general construction Senator Calder (New York) and Representative McLaughlin (Michigan) have presented bills S 2094 and H R 8080 entitled "A Bill to encourage the Building of Homes by Providing for Exemption from Taxation of the Income from mortgages on Real Estate." Passage of this act will make loans upon real estate more attractive to investors and will encourage the construction of homes so vitally necessary for the happiness and prosperity of our people.

At present a lot of first mortgage money is being diverted into other channels to escape income tax. The proposed bill will tend to keep this money in mortgages but the amount of relief afforded by this measure will, however, be so small that it will not make any appreciable difference with the carrying charges of a house.

The suggestion has been made in several quarters that new house construction should be exempt from local taxation for a period of five or ten years. The benefits of this in communities where the housing shortage is very acute would at once be felt, as local taxation usually runs about one-quarter of the rental cost of a house. It is a method often used to attract new manufacturing industries to a town and precedent for such procedure is therefore established. It may be objected, however, that the building of a number of houses adds a far greater burden to a town's expenses than an expenditure of equal amount in factory construction, as the houses usually call for an expenditure on sewers, water, etc., out of a town's funds and an additional tax on the town's school facilities, fire protection service, police, etc. The exemption from local taxation, therefore, can only be considered an emergency measure. It is not economically sound and should only be used as a means of causing all classes of a community to contribute towards the

relief of a town's housing shortage where other methods of enlisting their support have failed.

II—SOURCES OF CAPITAL—METHODS OF FINANCING—SELLING PLANS

Home Buying Problems of the Individual

Individual builders or purchasers of dwelling houses are sometimes confronted with problems of finance that give little annoyance to their more fortunate brethren. The growing shortage of dwellings and the decided increase in rentals have expressed themselves naturally enough in "Own Your Home" campaigns and have greatly intensified the normal desire of the American Family to own its home.

For the man of moderate means the establishment of a home presents a real financial problem to be solved in accordance with his individual requirements and available capital. Care should be exercised in determining whether or not the property considered for purchase has been fairly appraised, after which there are three general methods of payment usually open to the home buyer for consideration, namely:

1. Cash payment.
2. Initial cash payment of about 40 per cent, assuming first mortgage for balance.
3. Time payment or installment plan.

Method No. 1 involves no special problem if sufficient funds for the purpose are available and cannot be invested to better advantage as regards interest and security.

Comparing methods No. 2 and 3, it will be generally found that under average conditions the former has several advantages over the latter; (a) larger choice of properties to select from; (b) saving in cost measured by a somewhat better price than in most cases might be obtained on the property; and (c) a distinct advantage in the smaller actual monthly cash requirements. The first two advantages listed do not always hold true although the last presents a real advantage.

Practically any investment company or bank (excepting those operating under national charter) will handle the first mortgage usually to the extent of 50 or 60 per cent of the appraised value of the property. Interest is paid at specified intervals at the current rate and a long-term period allowed for repayment. While the obligation assumed does not call for any monthly reductions of the mortgage and no immediate risk would be involved in not providing for same, it is recommended that some provision be made for amortizing the debt by making payments at regular intervals or providing for the eventual retirement of the mortgage by building up a reserve fund by monthly savings equal to at least one-half of one per cent of the principal. It is also highly desirable that further provision be made for the retirement of the obligation upon death by providing for ample life insurance. These recommendations would apply in case of either of the last two methods of buying referred to (No. 2 and 3).

It is very important to emphasize the need of making proper pro-

vision in any sales plan for the amortization of both first and second mortgages. We recognize the fact that a house will not and does not last forever, yet this fact seems to be lost sight of in the usual negotiation for mortgages and the financial difficulties of many investors may be traced to the fact that mortgages placed on a conservative basis soon become very poorly secured if the mortgage debt is not reduced. Whenever a man buys an automobile he has to reduce his debt very quickly and in buying pianos or furniture on the installment basis, his repayment of principal is usually as large or larger than the amount of interest he is paying on his debt. The same idea ought to be adopted in the purchase of a house.

Several methods of time payment are presented for consideration.

(a) An initial payment of 10 per cent of the total purchase price and the assumption of a first and second mortgage for the remainder; the first mortgage to be for approximately 60 per cent of the property value. The property is deeded to the purchaser who usually arranges for the first mortgage, with interest payable semi-annually or quarterly and payment of the principal deferred until after the second mortgage is paid off. The second mortgage usually accepted by the seller is generally repaid at the rate of about one per cent per month in addition to the monthly interest on the balance, which is automatically reduced as the second mortgage grows smaller.

(b) The property is deeded direct to the purchaser by the seller, clear and free of all "incumbrances" (liens, mortgages, etc.), upon initial payment of 10 per cent; the purchaser at the same time executing a first mortgage for the entire balance, usually payable in monthly installments of not less than one per cent each, with interest on the balance at the current rate, payable monthly or quarterly. At option of the buyer or seller agreement may be stipulated for repayment of principal at longer or more frequent intervals as may be desired at a rate equal to about 4 or 5 per cent quarterly.

(c) The seller retains title to the property or transfers it to a trust company to be held in trust for buyer and seller. The seller executes a "contract for sale" which contains terms upon which the trust company can eventually deed the property to the purchaser. At the same time the buyer executes a bond or note for the balance of the purchase price and interest calling for payment in the same manner as in the (a) and (b) plans. In this plan, (c) the buyer is fully protected as there is less likelihood of complication through the death or bankruptcy of the seller and there is no risk of the title being defective or the possibility of unpaid liens, arising unexpectedly where the property is deeded to a trust company. In dealing with a trust company the buyer is also sure of receiving deed to the property immediately upon full payment of his obligations as the trust company operates "perpetually" at a definitely known location.

In arranging for the purchase of a house on the installment plan the buyer must in the majority of cases pay down at least 10 per cent of the cost of the property, at the time of making the transaction. In most cases the prospective home buyer has saved the amount of his first payment or has securities or property upon which he can borrow sufficient funds for the purpose. Any selling plan which provides for

initial payment of less than 10 per cent is not to be recommended. The borrowing of money by a purchaser to make his initial payment is bad practice and should be discouraged.

A plan for home purchasing should be worked out on such terms as to destroy the old belief that it is cheaper to pay rent than to buy. The fact should be thoroughly learned that every family is paying for a home. It is argued that home ownership assumes the burden of taxes. repairs and rent, which is true, but the fact should not be lost sight of that the taxes, insurance and repairs of the rented house are paid by the landlord out of the rent which the tenant paid, and so the tenant is paying for these items on the landlord's house. Such financial plans should be evolved as would make it possible for every family to procure a home of its own by payment of periodical sums approximating the rent which would usually be charged on the property.

Builders, Contractors, Real Estate Operators

Builders or contractors, often called upon by prospective buyers for advice concerning the best means of financing their ventures in home building should keep posted on the sources of financial aid that are available to their clients and acquaint themselves with a number of plans that have been employed successfully so that they may offer practical suggestions and advice in connection with their clients' problems. The builder should be acquainted with the local building and loan associations and other institutions or individuals in a position to loan money on real estate so that he may direct prospective buyers to sources from which they can borrow at lowest prevailing rates and under most favorable conditions. In case the client is unable to finance his home on the amount borrowed on a first mortgage, it is often possible and advisable for the contractor to take a properly executed second mortgage on the property to cover a part of the contract price, payable in regular installments. In assisting the client in his financing problems it is advisable to consider very carefully the various selling plans and if possible make arrangements to have any loans which may be extended on either first or second mortgages paid off at regular intervals.

Full payment or an initial cash payment equal to the difference between the permanent mortgage and the selling price described under "Home Buying Problems of the Individual" (Methods 1 and 2) naturally offer the best solution to the builder's selling problems as they provide a quick means of payment and do not make it necessary to carry the less marketable second mortgages; but the number of people in a position to undertake the construction of a home under these conditions is limited.

In plan "a" discussed under the time payment or installment plan the seller comes into immediate possession of 10 per cent cash and a first mortgage that he can easily negotiate and is only called upon to carry the second mortgage which is paid off in monthly payments.

The principal objection to plan "b" is that the seller would in all probability have to carry the entire load until it had been reduced to about 60 per cent or stand a very large discount if he desired to realize on it. In such a case, it is not unusual to add to the purchase price to

make up any probable loss the seller might have in selling or discounting his mortgage.

Plan "c" protects the buyer and seller equally and will prove a very satisfactory method of financing the small home buyer.

To assist in the present emergency in getting more homes built quickly in Detroit the House Financing Corporation formed for the purpose, has inaugurated what is called the "Contractors Financing Plan." At proper stages in the transaction financial assistace is extended to the contractor on new operations to be undertaken by advancing cash to him in the form of loans on certain defined terms and conditions covering type of house, location of property, selling price, etc. This plan has worked satisfactorily in Detroit, but is not alone sufficient to meet the present building requirements, although of considerable help to the contractor with limited working capital in financing clients unable to pay cash for their homes.

Another factor retarding house construction is the cost and risk assumed by the inexperienced home seeker in purchasing a house prior to construction. A solution of these problems is the construction of houses on a wholesale plan. The majority of houses that have been offered for sale, whether attractive or unattractive, have been built on a retail plan and the cost has been correspondingly high, requiring initial and subsequent payments that seem prohibitive. As a solution of these conditions, those interested in the construction of houses, including the contractor, real estate operator and larger employer of labor, should by means of a cooperative system undertake the erection of homes upon a large scale. Building upon a wholesale basis will do much to decrease their cost through economy of design and purchasing materials and saving labor and thus make it possible to sell cheaply and upon easy payment plans.

Community Housing Corporations

Industrial communities that cannot offer the workingman and his family decent living quarters now find themselves face to face with a crisis that is demanding serious attention. Men well housed in sanitary dwellings are healthier, more efficient and less troublesome than men forced to live under crowded and insanitary conditions. The output of a plant is seriously effected by the prevalence of sickness often caused by overcrowding and lack of sanitation in the workman's home. The better labor is housed and cared for, the greater will be its efficiency and output. The industrial employer situated in poorly housed communities finds himself heavily handicapped when forced into the present market to compete for skilled or even unskilled labor and is beginning to realize the tremendous importance of these conditions and their relation to production.

A report of the housing committee of the Bridgeport Chamber of Commerce in 1916 is quoted to illustrate the importance of proper housing to industrial communities:

> 'The housing situation in Bridgeport is not only acute, but the evils of congestion and rapid growth have been intensified by the delay in taking some decisive action and the situation becomes automatically worse from day to day.

There is no hope that the building and real estate interests of the city which are equipped only to meet the ordinary increase in population can, under any circumstances, provide for the requirements of the present abnormal increase in population.

Under such circumstances your committee believes that the continued success and efficiency of the present manufacturing establishments of the city as well as the future development of Bridgeport as an industrial city are seriously menaced by the comparatively higher rental of real estate and general inadequacy of housing conditions as compared with other and competing manufacturing cities. Such a condition in a city whose industries are so exclusively manufacturing involves the welfare of every business interest and property owner in the city.

In the opinion of the committee the only available solution of the problem is by the general and combined effort of every interest in the city to finance and carry out the erection without delay of a sufficient number of houses to relieve at least the acuteness of the present demand."

In the spring of 1919, the government was very much concerned over the lull of general business that followed signing the Armistice. A "Build Now" campaign was inaugurated and sponsored by the United States Department of Labor to ward off the pending disasters that would result in shutting down business and throwing men out of employment.

"Own Your Home" campaigns fostered by the Chambers of Commerce, civic and other associations were launched in about 100 different towns and cities throughout the country. These organizations rendered a real service not only in stimulating a desire upon the part of many to own their own homes, but also in directing the attention of employers, builders and investors to the need for this class of construction.

However, such campaigns alone cannot accomplish the desired results in increasing the actual construction of houses unless ways and means of building and financing homes are provided to solve the problem.

The important problem in financing small house construction is to fill the gap between the amount obtainable on first mortgage and the amount the purchaser is able to pay in cash. At the present time it is difficult to obtain over 50 per cent of the cost of a house on first mortgage and it is rare to find a purchaser who has more than 10 per cent of the cost which he can pay as a first payment. This leaves about 40 per cent to be covered by a second mortgage, and employers of labor or local housing corporations must be prepared to assume the risk of lending as large amounts as this in order to cope with the housing shortage.

It has been suggested that a better method than loans on first and second mortgage would be the placing of a first mortgage of 90 per cent or whatever the total amount loaned may be, this mortgage being held by the housing corporation and used as collateral to obtain a loan of 50 or 60 per cent from banks or other investors or as security for first mortgage bonds of a like amount. The security offered to the bank or bond holder is better than that afforded by a first mortgage as the whole credit of the housing corporation is back of the loan instead of the only asset being the value of the individual house and land and it is thought that larger amounts may be released in this way than by the former method of first and second mortgages.

A housing corporation naturally desires to have its funds released

entirely within a reasonable length of time and some have loaned on second mortgages and stipulated that at the end of a six year period the balance of the second mortgage which has not been amortized should be payable on demand. The principle is a sound one but should be applied with caution as the strict enforcement of such a provision in a time of financial stringency would work a great hardship on the individual home owner, whom we desire to aid.

Before definite steps are taken to organize a home building company, a thorough investigation should be conducted to determine carefully the housing needs of the community and whether or not the project can be entered into extensively enough to provide an adequate remedy for the housing situation. Also whether it is possible to provide dwellings at a cost low enough to meet the financial resources of the prospective buyers. The investigation should determine whether sufficient funds are available to finance the project and what returns may be derived from the investment, considering the possibility of reducing labor turn-over, attracting better classes of workmen, building up the community and its industrial interests and enhancing property values. These questions naturally suggest other closely related problems that should be solved to meet local requirements. If after careful deliberation it is determined that community housing is desirable for the welfare of the community an effort should be made to organize the various interests to whom an appeal can be made for working capital or funds sufficient to finance the project. The procedure may be outlined in the following manner:

First: Take up the matter with the various business interests of the community and endeavor to combine the financial resources to their mutual advantage.

Second: If several employers of labor can be found who can agree on the need of houses even though building operations may be scattered in various parts of the city, they should get together and form a housing project designed to erect, rent or sell low cost dwellings on easy payments.

Third: Effort should also be made to interest other investing factors of the community which may include various business organizations, contractors, builders, real estate men, merchants, banks, trust and insurance companies and the general investing public. It is sometimes possible to interest the municipal, state and federal governments to the extent that special appropriations be made to relieve housing conditions.

Fourth: The charter of the association should be carefully drawn up so as to embody as many desirable features as possible. Among the general requirements considered particularly desirable in order to insure successful methods of financing might be mentioned the following: (a) Supply funds quickly, (b) give a reasonable return on the investment, (c) permit further expansion and (d) avoid, when possible, the necessity of tying up the investors' funds for any great length of time. (e) Shares of small denominations should preferably be issued so as to appeal to the small investor, and (f) provision made to permit the exchange of stock for its equivalent equity in the property of the corporation.

Fifth: The type of organization which properly meets all the requirements is a joint stock corporation wherein an indeterminate number of individuals voluntarily associate for the purpose of providing capital for a given enterprise, the capital being divided into transferable shares, ownership of which is a condition of membership. The advantage of this form of organization would be that there is an equality of interest and that it provides the principal of an association, not only as to capital, but also to management, for the investors can elect directors or a board of management to conduct the affairs of the corporation.

The capital stock divided into equal shares, readily transferable, allows all shareholders to benefit proportionately since there is no preferred stock, the possession of a given number of shares indicating the owner's part in the income of the enterprise. The sale of a large number of transferable shares permits the expense of the project to be widely distributed and the element of incorporation removes the individual liability of stockholders resulting in greater financial stability. An added advantage to stockholders desiring to build homes of their own is found in the provision allowing for the exchange of stock for an equal equity in the property of the corporation. Future growth and expansion and its consequent necessity for increased capitalization can be taken care of by an additional issue of treasury stock at the time of incorporation, or if so provided in the charter, by a majority vote of stockholders to issue additional capital stock to the amount required; or last, by reorganization.

Sixth: Bearing in mind the desirability of making the investment as stable and secure as possible to the stockholder and having determined the extent and cost of the initial operations, it would be necessary to fix the annual amounts required to pay a fair dividend to the investors, take care of taxes, upkeep and operating expenses and have enough left over to go into the surplus or reserve fund.

The selling plan should be well worked out before construction is started. This plan will be influenced to some extent by information collected from the survey, particularly with reference to the financial resources of the prospective buyers. It is generally found that workmen are willing to purchase well made houses if the way is made easy.

It is usually advantageous to retain an option on the property where it is sold to workmen providing for the repurchase of the house by the company if the workman wishes to leave, and some method should be employed for estimating the amount of depreciation and appraising the current value of the property. It also seems only fair that any unearned increment should pass to the company and not be retained by the buyer as otherwise it would encourage speculation to the disadvantage of the building corporation.

An interesting example of the part municipal governments may play in providing for suitable housing is illustrated in the Winnipeg plan. A housing commission recently appointed has decided to stimulate the building of homes by making a loan of 85 per cent of the net cost of the building. A first mortgage will be taken on the property for 20 years, repayable at the rate of $7.13 a month for each $1,000 borrowed. The builder may select his own lot in any part of the city and pay any part or all of the borrowed money without notice at any time.

The plan adopted by the Housing Committee of the Hartford (Conn.) Chamber of Commerce (December 29, 1919) for meeting the housing needs of Hartford during the next few years is of especial interest because it contemplates first: a method of assisting employees in the construction of houses on their own account, and second: the construction of houses for sale.

The main defect in most financing plans is that all the risk is placed upon the individual and as a result they have not produced results in the quantity or quality that had been expected. When a city or town feels itself in need of houses "the way to get houses is to build houses" and not to offer to lend money to the other fellow and ask him to take all the risk. In the present era of high prices, the individual is very timid about entering into building contracts, selecting plans and building houses. But when the local housing corporation has shown a willingness to take the risk of building houses and the purchaser can see what he is buying he is far more likely to become a home owner or purchaser. His risk is known and costs can be definitely measured, and the fact that the housing corporation has backed its own judgment by building houses is evidence to him that he will not be foolish to own one that they have built. Furthermore, the housing corporation building on a large scale can take the advantages to be gained by quantity production by purchasing wholesale and by the continuous employment of large gangs of men. This is particularly important in considering the concrete house as most systems of concrete construction show much greater advantages in economy and speed when produced on a wholesale basis.

Industrial Housing Projects

In the larger cities the housing projects are best provided for in the organization of housing companies through which the various manufacturers may combine with other business interests to raise the necessary capital to take care of and remedy the housing situation. Often large industrial corporations are pressed to take up the question in self-protection and as individual enterprises, even though sometimes considered undesirable for the manufacturing corporation to build houses either to sell or rent to their employees. Many corporations, especially in the smaller towns and far from the labor markets, have been forced to provide housing in this way and have been successful in maintaining the most favorable relations with their employees and in materially reducing the expense of labor turnover.

In the present labor situation with demand far exceeding the supply, the workman will no longer be content with the disgraceful housing conditions he has had to put up with, and as fast as manufacturers bid for his services, by putting up decent houses, he is going to leave the old insanitary, crowded centers to go to the new villages where he can live decently with his family.

When a manufacturer advertises that he can offer attractive housing conditions and a satisfactory environment in which to live and rear a family, it signifies recognition of the fact that labor is demanding better housing and that progressive manufacturers realize that it is to

their advantage to furnish such houses. The DuPont Chemical Co., now operating on a peace basis, finds that it has a surplus of factory sites and equipment in its war-town of Hopewell, Va., which it is trying to sell through country-wide newspaper advertising. In its advertisements, the following mention of housing appears:

> "The housing problem is so closely allied with the problem of labor that a manufacturer in these days must interest himself in what sort of homes are available for his employees. The scarcity of housing and the consequent high rents lower the efficiency of labor as well as limit its supply.
>
> Hopewell has no 'Housing Problem.' To accommodate its vast army at Hopewell, the DuPont Company built hundreds of cottages, bungalows and dormitories. These pretty houses with lawns and gardens bordering on well paved streets are equipped with electricity and all modern improvements."

The importance the DuPont Company has placed upon housing in its advertising campaign to sell factory sites, is evidence of the recognition given this problem by the large employer of labor.

It is not absolutely necessary, however, that the manufacturer conduct the real estate and building operations in his own name. A separate corporation or subsidiary company may be formed to carry out such work. A good example of this plan of operation is the Indian Hill Co., a subsidiary of the Norton Co., Worcester, Mass., organized to build and sell homes to their employees.

The problem of organizing and financing the home building project for the manufacturer and for the Community Home Building Corporations have much in common. The same general conditions hold true, the only fundamental difference being the source of capital which, for the industrial project, must be provided generally from working funds of the company.

C. L. Close, Manager of the Safety, Relief, Sanitation and Welfare Department of the U. S. Steel Corporation, has said in a recent article:

> 'The housing of employees requires the expenditure of large sums of money. That money must be taken out of the business. As part of the capital of the enterprise it must yield returns to those who have invested it. But money invested in building houses for employees will not bring any such return as money employed in the manufacture and sale of products of industry. Therefore, a board of directors is compelled seriously to consider how far it can properly withdraw capital for the construction of industrial houses and villages. It is easy to say that the diminished returns on this capital are made up by larger returns on the remainder of their capital, due to better work done by more contented workmen. We firmly believe this, but it is not a thing which can be demonstrated by the books of account.
>
> Behind all housing problems lies the most important one of all. An industrial enterprise must be so conducted that it shall earn enough to provide proper working conditions for its employees, to pay fair wages, and to return a reasonable profit to those who have invested their money in it."

Labor turnover is not touched upon by Mr. Close in the above statement although any reduction that can be made will result in more efficient operation and increased returns on capital invested in the business. Six cement companies have analyzed their labor turnover for a period of three years reporting an average of 103 per cent per annum and it is not uncommon to find manufacturing plants in all industries with an

annual labor turnover equal to 400 per cent. An investigation made by the Niagara Falls Chamber of Commerce showed that the labor turnover in that city approximates 38,000 persons per year and that adequate housing would reduce this by 10,000. If the cost of labor turnover is taken at the conservative figure of fifty dollars ($50) per employee, this would save Niagara Falls manufacturers one-half million dollars annually.

Manufacturers have generally avoided the housing problem when at all possible, and for a good reason, but the present crisis is forcing upon them the conviction that they must tackle it and that in the future they must control it.

When houses are built a most important problem presents itself for consideration in the decision as to whether the houses are to be sold to the employees or rented. If the houses are sold to the workmen objections to be met are that if the workmen leave the employ of the company they still retain possession of the house although it is wanted for other workmen; also that if they can sell at a profit the increment in value which has been put into the house by the presence of the plant goes to the workman who has not earned it. These objections can be overcome, however, by retaining an option on the property providing for the repurchase of the house by the company in case the employee desires to dispose of his property.

Where houses are rented the owner has more control over them, although he usually has difficulty in taking care of the property, especially in the event of a strike. The tendency seems to be towards the selling of the houses and several selling schemes are presented here as fairly representative.

III—PERMANENT HOMES BEST INVESTMENT

Safety of principal is of paramount importance to the investor. It is, therefore, especially desirable that the building upon which money has been loaned be subject to as little deterioration and other hazards as possible, thus keeping the security value unimpaired. The home buyer gains considerable advantage in purchasing a home that is permanent, fire-safe and free from heavy up-keep expense. The owner of such a home is often able to have a second mortgage discounted at a lower rate and also receive the added advantage of a lower insurance premium.

Sinking fund requirements for deterioration and up-keep are reduced to a minimum enabling the home buyer to increase the amount of his payments on the principal. There is the added advantage in being able to estimate more accurately the maintenance charges on a permanent dwelling as they amount to a much lower percentage of the cost and are less variable. During the past five years the cost of maintenance has increased enormously, making elimination of many of the usual up-keep charges a very desirable feature.

The cost of insurance is another important matter to the home buyer and to the investor who has loaned money on real estate mortgages. During the last two years the cost of building has increased

generally 60 to 100 per cent, yet in many cases the insurance on the property has not been increased to meet the increased cost of rebuilding in the event that the structure is destroyed by fire.

One of the most important reasons for the shortage of houses and the unattractiveness of the house as an investment is the fact that receipts from rent are usually not enough to pay a fair interest and allow for depreciation. The investor who puts his money into houses is entitled to a fair return on his money and the tenant does not want and does not need to be dependent on the gifts of others or on federal or state relief to help him pay his rent. It is very necessary, therefore, that the cost of maintaining the house be carefully studied and rents calculated on such a basis that the landlord can make at least the prevailing rate of interest (say 6 per cent) on his money after payment of maintenance charges and allowance for depreciation.

The concrete house figures particularly favorably in this respect as maintenance and depreciation on a concrete house are much less than on houses of frame construction. In fact, assuming a house of frame and of concrete construction to cost the same (for example, $5,000), it will be found that the concrete house can be rented at a lower figure. In any house of this size there is at least $1,000 in items like plumbing, heating, painting, etc., on which a depreciation item of at least 5 per cent per annum should be allowed, total $50 per annum; on the rest of the concrete house structure 1 per cent is ample but about 2½ per cent is as low as can be considered safe on the frame house. One per cent on $4,000 equals $40 per annum, while 2½ per cent equals $100 per annum so that the total allowance for depreciation and maintenance on the frame house should be $150 per annum, but on the concrete house only $90 per annum, a saving of $60 per annum, or $5 per month.

COMMITTEE ON FINANCING PERMANENT HOMES

Jas. F. Basiger, *Chairman*, Chicago
Leslie H. Allen, *Secretary*, Springfield, Mass.
M. L. Dowse, Kenosha, Wis.
Fred L. Dennis, South Bend, Ind.
J. K. Harridge, Chicago
Col. Abel Davis, Chicago
K. V. Haymaker, Washington, D. C.
Mark D. Rider, Chicago

REMARKS.

WALTER J. PARSONS: I think the subject of financing homes is one of the most important to come before this Conference. I believe I may speak from the standpoint of personal experience. It is easy to build houses, it is easy to plan them, it is easy to talk about the material you are going to use, but it is not an easy thing to get the money out of the man who is going to build the house. The question of financing is the first one that has to be solved. There is a shortage of finance, as well as a shortage of material. We have been in touch with perhaps

over a hundred industrial concerns in the last six months. Practically all of them want to build homes for their employes.

We have found a very decided tendency toward cooperative action. High prices are driving us to such action. We must sacrifice and waive our desires to own this or that in fee simple, or have it for our families for generations to come, one reason for which is that we don't stay in one place as long as we used to.

In a cooperative way we can finance better and more cheaply, can build for less and more quickly, and can build more in a cooperative way than in a single or individual way.

Just to illustrate the tendency in that direction, I might say that we were approached about three weeks ago by a group of ten men in one of our principal cities, who asked us if we could not formulate a plan by which they could buy a piece of property of perhaps 50 acres, paying a part down and holding an option on the remainder. These men wanted to form a co-operative association of 25 members to build 25 homes for themselves, cost to be from $7,500 up. They were men of average means, and the principal object they had in mind was a new home in perhaps a little better district. They wanted the advantages of community life and they have a scheme now on which they are working, as a result of which they will secure 25 members and then sell the remainder of their property to outsiders. They will not only build houses for themselves but also for these outside persons.

That plan is going to cheapen the house of each of the 25 charter members. The selling value of the property will, of course, be advanced and selling the property is going to reduce the cost of these 25 houses to this club or association. They are going to have a central heating plant and a central service station. They will secure a lot of community benefits which are fine. All of us would like to have them and they are going to realize them in this cooperative way. Incidentally, the final cost to each is going to be at least 25 per cent under what it would be were they acting independently as individuals. This is a plan that can be used in any mixed community. It presents a way of financing home building through cooperative action.

WM P. PARKER: In connection with the financing of houses, I want to emphasize one point: that is, the difference in maintenance cost between some houses and concrete houses. There is a good deal of difference, but I think we can readily prove that in a concrete house for the same amount of money you can give a man a house that is $1,000 better.

LESLIE H. ALLEN: In what is called the "Detroit Plan," which has been followed in a number of other cities, a service charge is made of some $300 per house as a part of the cost of the house. From this it is expected to pay the expenses of running the corporation and form a dividend which is usually limited to 6 per cent. Many corporations would rather appeal to the interests of the community at large than for any financial gain, the reason being the same as that for which we subscribed for Liberty Bonds—not because the rate of return was high, but because it was good for the United States. A manufacturer cannot do

business without a power plant. His power plant does not pay the dividends, but he must have it. The housing corporations, such as those in Bridgeport and Worcester, as well as others I might mention, are not expecting to pay dividends direct. At Bridgeport, Conn., the increased investments show a handsome profit. I do not think the new service corporations that do not make a service charge to the individual will show any return beyond perhaps 1 or 2 per cent.

THE GOVERNMENT'S HOUSING EXPERIMENT

By LeRoy K. Sherman
President, United States Housing Corporation, Washington, D. C.

The United States Government was forced to take measures to provide housing in those localities which were congested by activities in the production of war materials and the construction of ships.

The United States Housing Corporation—a Government Department—completed the construction of some 6,000 houses, located in 24 different places from Vallejo, California, to Bath, Maine. These houses were rented as rapidly as completed and they are now being sold. The law provides that first choice, after the houses are valued by a Board of Appraisers, shall be sold to the individual home owners. The terms of the sale are 10 per cent down and monthly payments of 1 per cent which includes any interest charges. It is expected that all of the houses will be sold and in the hands of the individual home owners by the first of July, 1920.

The housing shortage is well nigh universal, and loans for housing projects are now being made by the Governments of France, England and Canada. In addition Government Bureaus giving indirect aid have been established in Italy, Sweden, the Argentine Republic and elsewhere. In our country there is need for remedial legislation to aid private financing for housing, such, for example, as is provided in the bill of Senator Calder. A small agency to coordinate and make available housing data and standards as provided by Senator Tinkham's bill is very desirable. Such a department is expedient from the fact that the Housing Corporation has during the past year received over 2,000 different inquiries relative to industrial housing, and that it has furnished some 300 paid-for copies of Government Housing Plans.

There is no apparent intent on the part of the Government to continue in the business of directly furnishing houses. I do not think that the Government in this country should directly furnish houses, as private capital can be made available.

Most war expenditures are an entire loss. The Government's housing venture has returned a most excellent salvage. There has been a good financial return as well as the incidental fact of making several thousand Americans owners of their own homes.

When the Government housing for war industrial workers was initiated, then for the first time in history collective housing operations were comprehensively undertaken. For the first time all of the various agents of housing—the realtors, architects, engineers, town planners, builders and material men—were united in one building corporation. That plan has carried. There are many score of housing corporations operating on that same basis.

A most careful analysis of the cost of housing has been prepared recently by some of the architects, engineers and builders who served with the Housing Corporation and who have had national experience in their lines of work. Under this analysis we find that the cost of housing

in June, 1919, had increased 70 per cent over the cost of housing in 1913. The analysis further shows that the increased cost of materials and the increased cost of labor were each equal to 70 per cent. During the past six months there has been a somewhat further increase in prices. This percentage was worked out very carefully from specific cases and there are wide variations from this figure in particular localities. The details of this cost analysis have been recently published in the "American Contractor" and the "Engineering News-Record."

The solution of the housing shortage, under the high prices of today will come from collective building by such housing corporations combined with the constructive genius who can, in his designs, assemble such materials as will produce a good house with the least expenditure for field labor. Of the six thousand houses constructed by the U. S. Housing Corporation the bulk of them consist of 4, 5 or 6-room, two-story frame detached houses. Next in number follows the stucco house, then the vitrified tile and finally brick. The selection of material was governed largely by the rules of the War Industries Board, the utilization of local material to avoid transportation, and the scarcity of cement. A very considerable number of other types of houses were built, such as the double house, rows of brick houses in blocks, apartment buildings and, occasionally, two-story flats. As a sales proposition to the individual owner the two-story five and six room detached house was in greatest demand.

Apartment buildings (flats) were satisfactory from the renting viewpoint, but do not attract purchasers among the individual home owners. Most of the houses were provided with basements or cellars and generally the foundation walls of the cellars were monolithic concrete. In many cases concrete block were used. A concrete floor was provided. It was found there was much complaint from wet cellars. This was generally remedied by simply banking up the surface of the back filling which had settled around the cellar walls. Concrete block walls for cellars should be plastered on the outside if they are to be as water resisting as the monolithic walls. The specifications called for a lean mixture of concrete for cellar floors. This was a mistake and made trouble from dampness which could have been avoided had a richer mixture been provided. Hot air furnaces were generally installed in the basement for heating the houses.

In this Government housing experiment we have learned to do many things. What is still more valuable, we have also learned things not to do. We have learned that the successful type of house varies by localities. We have learned that proper town planning and planting can increase the selling value of the house more than any other dollar of investment. We have also learned that the idea of some town planners in omitting alleys and providing unduly wide lots is a physical and financial mistake. We have learned that plumbing is unnecessarily expensive (from $50 to $100 per house) and that it is caused by many municipal plumbing codes which have been established by selfish interests. We have learned that standardized houses can be built which will not look standardized. The selection of a housing site is often governed more by the probable cost of public utilities than it is by the first cost of land. We have learned, but we have not successfully taught our tenants, that rents include many things besides profit to the

owner. In general it will amount to about 13 per cent per annum of the value of the property as follows:

Maintenance	2 %
Taxes	1.5%
Insurance	.3%
Depreciation	2.5%
General Expense	.5%
Vacancies	1.2%
Interest	5 %
Total	13.0%

The new house of today has to compete with the house built in pre-war times. The rental of these houses has increased perhaps 20 to 30 per cent. This represents a satisfactory income to the owner of the pre-war property. An entirely different situation exists with respect to the owner renting a house built in 1919. A 30 per cent increase over 1913 costs will not bring the owner of a new building a sufficient return when the new owner has to compete with the owners of property built before the war.

In many places in the country the housing shortage is so acute that new buildings are readily rented or sold at today's prices. The average builder of today has to adopt the most economical and efficient procedure in collective housing construction, standardization, and provide conveniences and artistic arrangements, so that the added attractiveness will invite occupants in spite of the higher rental or cost.

REPORT OF COMMITTEE ON FIRE PREVENTION

"Fires in the home are easier to prevent than to extinguish.

"Unlike factory fires, many of which are due to causes inseparable from manufacturing, practically every dwelling house fire is due to carelessness or neglect. Especial care should be taken in the home to prevent fires from starting, because when they do start there is seldom a man about to extinguish them. Where women and defenseless children are housed, every human consideration demands the utmost vigilance on the part of those responsible for their welfare." (From Bulletin, "Dwelling House Hazards" of the National Fire Protection Association.)

General Discussion of Defective Construction in Dwellings and Its Relation to Their Fire Hazard

The American home—usually a model of convenience and comfort—has been developed with little thought or consideration as to the fire hazards or the means of safe-guarding lives and property against the ravages of fire. We have made wonderful progress along other lines tending toward conservation of natural resources, not excepting conservation of life, yet today the majority of houses are built to burn—not to endure.

For a number of years the annual fire loss of the United States has represented an amazing and needless waste—loss of life, employment, property and natural resources. In all too many cases, when a fire once starts in a home, the building is soon transformed into a smoking ruin, indicating a serious defect characteristic of modern construction. This annual fire loss is the more significant because the majority of fires occur in the home. Statistics gathered from the reports of the Actuarial Bureau of the National Board of Fire Underwriters show, for example, that during 1917 there were 232,021 dwelling house fires with a consequent loss of $66,166,420, the number representing 65 per cent of the total fires reported and the loss 28.5 per cent of the whole.

While much of this loss is traceable to household carelessness other prolific causes such as overheated furnaces, defective chimneys and flues, and the like, are related to the construction of the house. Attention to these features as well as those designed to prevent the spread of fire within the dwelling would go far toward reducing this annual loss to the householders of America.

As a guide to the better protection of lives and homes against fire, your Committee recommends the Code of Suggestions for Construction and Fire Protection, issued by the National Board of Fire Underwriters. The data and suggestions contained in this code which relate to the construction of concrete dwellings have been freely used by your Committee in the preparation of its report. We quote in part from Section 2, Part I, under "Dwelling Construction Under Slight Control," as bearing on the importance of this subject and the need for legislation and standards, governing the construction of dwellings:

1. Municipal building codes place little restriction upon the construction of dwellings. Within the fire limits which commonly comprise a small congested portion of a city's area, frame dwellings are usually excluded; wooden shingle roofs prohibited; regulations regarding chimneys, heating appliances and lighting are enforced and in most codes some provisions for fire-stopping walls and partitions are made, but not sufficiently explicit usually to be of much real service. Outside the fire limits any type of construction is permitted and the enforcement of other regulations is generally lax. * * *

2. Beyond the boundary lines of cities and towns which have building ordinances there are hundreds of suburban real estate developments and villages which have little or no building regulations and also vast numbers of dwellings scattered through the country which are under no restrictions whatever. Every builder is a law unto himself.

3. Dwellings have the least protection of any class of buildings. This results from a combination of careless construction, a lack of appreciation of the fire hazard which always exists, and isolation of the structures. The majority are absolutely devoid of fire resistive features. * * *

4. For people in moderate circumstances the home often represents a large proportion of the family capital and in all conditions of life it usually shelters things which are cherished because of tender associations and hallowed memories; things so treasured that their value could not be measured in gold or so rare that money could not replace them. Therefore the prevalent neglect of structurally safeguarding the home is surprising from a purely economic standpoint. No honest person can have his house burn without suffering serious financial loss even though supposed to be fully insured. However, the indifference to protection of property is not a tenth part so astonishing as the fact that not one private house in a thousand is constructed with any serious thought regarding the safe escape of occupants in case of fire although the annual loss of life due to dwelling house fires is appalling. * * *

5. When we consider that our millions of homes shelter the lives of all those held most dear—the old and feeble, the sick and infirm, the young and incompetent,—many of whom would be absolutely helpless if trapped in an upper story by fire, the situation is well nigh incomprehensible. The only explanation for this condition must be the lack of appreciation of the hazard which exists and the ease with which it can be entirely removed or greatly reduced. * * *

Section 6. Reasons why dwellings burn freely and the remedy.

1. The proportion of dwellings which catch fire and are a total loss, or which have building and contents ruined, is very high. The reasons are plain. First, in cities such buildings are usually located in outer areas more or less remote from fire fighting apparatus. Many are situated outside of city limits or in villages or suburban developments where fire protection appliances are meager and unreliable. * * * Second, dwellings are generally small and low so that a fire well started before discovery is likely to envelop all portions before outside assistance can become effective. Third, the majority of dwellings are of very combustible construction with open stairways lined with varnished or painted woodwork connecting all stories and with no provision for arresting the spread of fire from floor to floor or from room to room. The cellar where the heating appliance is usually located often contains much combustible material, a combination which is dangerous. Moreover, the cellar is more or less directly connected by open channels with all parts of the house including the garret. This results from lack of proper protection around water, gas and steam pipes, hot air pipes, dumb waiter shafts and open space through walls and partitions. Fourth, the nature of the occupancy is such that much of the time there are not enough able bodied occupants present to do effective fire fighting from within.

2. These four conditions combined, result in the enormous property fire loss and the sacrifice of many lives. The lamentable feature of the situation is that a large part of this loss could be prevented by reasonable precautions in construction and careful observance of the ordinary rules of fire protection. The cost of the former would be comparatively small, the only expenditure for the latter would be a little thoughtful vigilance.

The following recommendations, among those made by the Bureau

of Standards (Circular No. 75—Safety for the Household) all have a more or less bearing on the fire hazard and should receive due consideration when selecting or building a home:

1. All steam, water, gas, and hot-air pipes should be properly located and installed.

* * * * *

4. The heating arrangements, including furnaces, boilers and stoves, should be isolated, and protective measures should be adopted to prevent fire originating at such devices from being quickly communicated to the remainder of the building.

5. The electric and gas installations should be carefully installed and inspected so as to minimize danger from defective wires, unsuitable switches, outlets, and sockets, leaky pipes and burners, and other defective devices where the electrical energy and the gas are utilized.

6. Suitable safeguards should be provided against the dangers from heating devices and open flames to be used about the premises.

7. Suitable fire stops should be provided in the construction of the walls to insure against rapid spread of fire.

Note.—Continuous air spaces under floors and in walls, which permit fire to smolder for a long time, often without being noticed, should be avoided.

8. Windows, doors and other external openings should be protected against fire from near-by windows in the adjacent or from opposite windows in the same building.

Note.—Wire glass often affords an excellent means of protection where such exposure exists.

* * * * *

10. Roof construction, which provides an inflammable place for fire brands from outside fires to alight, should be avoided.

Note.—A striking illustration is the wooden shingle roof, by means of which many conflagrations have been spread.

11. Wooden lath on thin joists, a construction which burns through rapidly, should be avoided.

12. The use of wooden and other inflammable materials about chimneys should be reduced to a minimum, and continuous vertical air spaces should be eliminated by means of incombustible fire stops.

13. Woodwork surrounding hot-air pipes, flues and registers should be properly protected by incombustible material.

The U. S. Bureau of Standards in its Circular No. 75 has the following to say regarding "Exposure Fires:"

"The remedy to be applied for the hazards of 'exposure' fires is usually found in fire-resistive construction. This means a relief from the danger from fires in adjoining buildings and a step towards elimination of conflagrations. Many of the present types of dwelling construction in this country constitute hazards which frequently result in a very serious community disaster when a fire originating in one building spreads to neighboring buildings and gets beyond control of the fire-fighting facilities of the community."

Methods of Securing Maximum Fire Protection

In considering the question of fire protection and insurance we have endeavored to offer recommendations that will provide for a safe, practical and conservative construction, readily adapted to dwellings of concrete. Although the use of concrete in residence construction has been relatively limited compared with the extensive use that has been made of it in other building construction, the economic significance of the enormous annual fire loss in the United States is expressed in the ever increasing interest in the use of concrete in home building. This

has been especially noted recently in many localities where the problem of housing workingmen in industrial communities has called for immediate and satisfactory solution. The wide use of concrete for constructing industrial buildings has led in many ways to an extended and growing use of this material in large industrial housing developments. That real fire-resistive construction is the exception rather than the rule is due largely to a mistaken idea of the cost that building fire-safe involves.

The National Board of Fire Underwriters classifies dwellings as of four types according to construction; the first three types are peculiarly adapted to the employment of concrete.

Type 1. Buildings fully protected properly called "fireproof" in which all structural parts, including doors, windows and trim are of incombustible construction. Some buildings which belong in this class have minor doors and windows of combustible material, but where these do not serve as important cut-offs, or are not likely to be subject to serious fire exposure, their presence in the building would probably not materially increase the hazard.

Type 2. Buildings with partial protection; commonly (though improperly) called "fireproof." The term "semi-fireproof" would properly be applicable. Such buildings have walls, floors, roofs and partitions of incombustible construction, but with wooden floor finish, wooden trim, and ordinary wooden doors and windows.

Type 3. Buildings with walls of incombustible construction, but having all interior construction, including the roof, of wood; the roof covering either being of wooden shingles or some type of fire-resistive material. * * *

Type 4. Buildings constructed entirely of wood either with or without fire-resistive roof covering. Sometimes the walls are veneered with brick, or covered with stucco.

Type 1 buildings are in a sense idealistic, although an increasing number is being erected each year. The National Board of Fire Underwriters refers to buildings of Type 2 as follows:

"They are not subject to spread of fire through concealed spaces which is the worst constructional defect in dwellings; nevertheless, they are liable to destruction due to fire communicating from one portion of the house to another through open stairways, aided by the free use of wooden trim, doors and windows. Many houses of this type have been built in late years, some being costly and others medium priced buildings erected in groups for workingmen's houses in connection with industrial plants. With a little thoughtful care in the design of such buildings, and the exercise of prudence in selecting materials for trim, particularly where they are used in the place of fire barriers, this class of residences can be made exceedingly safe. There are several methods of constructing non-combustible dwellings of this type which cost but little more than a frame building."

There are a number of ways in which concrete can be used to obtain varying degrees of fire-safeness, secured by types 1 and 2. Briefly, there are four systems suitable for concrete dwelling construction recommended by the Committee as falling under these headings:

A. Walls, partitions, floors and roof of monolithic concrete construction, reinforced where and as necessary.

B. So called "unit systems" which mean that precast slabs supported by pilasters of concrete precast or cast in place, constitute the walls, floors, roof and partitions. Walls, partitions, floors and roof may be solid or hollow.

C. Walls of concrete block, tile or similar units, with partitions of metal studding and lath or of hollow concrete tile, or other incombustible material, covered with plaster. Floors and roof may be solid slabs of reinforced concrete or may have metal joists covered by thin reinforced concrete slabs, concrete tile or cement asbestos shingles or other approved covering. Walls, floors, partitions and roof may be solid or hollow.

D. A metal frame resembling that used in a house built of wood, to which metal lath or fabric is fastened and the exterior covered with portland cement stucco. Metal lath may be fastened to this frame on the interior which is plastered with ordinary plaster. Partitions may be of metal frame and lath like the exterior walls or of hollow concrete tile or other incombustible partition material. Floors and roof may be solid slabs of reinforced concrete or may have metal joists covered by thin reinforced concrete slabs or other approved covering. Metal lath is attached underneath the joists, then plastered.

The relative security of Type 3 buildings depends in considerable measure on the character of the roof covering. Combustible roof coverings, especially wood shingles, constitute an important fire hazard. The extent of the damage to the building would be much greater in case of a fire getting beyond control in such a building than in buildings of Types 1 and 2. These statements apply with equal force to buildings of Type 4, but there is the additional hazard due to the flue spaces between the wall studding through which a fire originating in the basement or attic can sweep with incredible rapidity. This hazard can be almost entirely eliminated by fire-stopping the walls, but unfortunately efficient fire-stopping has not come into general practice. In respect to the danger from exposure to fires in neighboring buildings, the house covered with portland cement stucco particularly on metal lath or fabric has an obvious advantage over the house with wood weatherboarding, especially if incombustible roof covering is used in both cases.

Supplementing the instructions for the reduction of fire hazards given in Part I, your Committee makes additional recommendations, applying particularly to the reduction in the fire hazard in Type 3 houses.

CONSTRUCTION DETAILS, WALLS AND PARTITIONS

Substantial walls are of great structural importance in every dwelling. They must not only render satisfactory service as regards carrying capacity and resistance to weather, but they should also be efficient in case of fire, which means that they shall be substantial enough to withstand the expansion stresses resulting from continued severe heat.

"It is poor economy to skimp footings. If they are insufficient for the load they carry settlement is sure to come in time, producing ugly wall cracks, misfitting doors, openings which will let in ground water and other defects, which plague the occupants as long as the house exists. The settlement of foundations is also liable to produce chimney cracks, and so cause a fire hazard."

Partitions of concrete units or of metal lath and portland cement mortar are to be preferred for Types 1 and 2 previously mentioned—and also for bearing partitions in the other types.

FLOORS

The National Board of Fire Underwriters makes the following recommendation regarding the importance of constructing a horizontal cut-off for cellars:

1. As the heating equipment of most dwellings is located in the cellar or basement, where subject only to occasional supervision; and as that space is also usually a storeroom for fuel and all sorts of combustible material, the chances of a fire are evident. * * * The remedy is to confine such fires at the place of origin by a cut-off between the cellar and the story above by making the

separating floor as fire resistive as possible, consistent with the type of construction and to properly protect all openings to same as herein provided.

2. The best possible cut-off is a fireproof floor. Such floors are a requisite for dwellings of Types I and II. They are equally applicable to dwellings of Type III. * * * They should be used wherever possible, for they constitute a distinct safeguard. * * *

Such floors may be constructed entirely of reinforced concrete; a composite construction of reinforced concrete beams filled between with hollow tile or metal or plaster forms with a reinforced concrete covering may be employed.

3. In buildings where steel beams are not otherwise used, it is probable that some variety of concrete floor construction would be the simplest and most economical. The forms could be easily supported—no hoisting of concrete would be necessary and as the floor would be laid before the rest of the building was erected, all the form lumber could be used again for other purposes. In order to reduce the span and thickness of the floor slab and thereby lessen the expense, the floor could be divided into panels by having beam supports at one or more intervals. * * *

4. Reliable building constructors state that such concrete floors can be built in most localities at practically the same price as first-class wooden construction. Owing to the fact that the fireproof floor is also waterproof, vermin proof and thoroughly rigid, it would justify increased cost. If desired, a wooden finish flooring may be laid over the concrete (see Sec. 29, Para. 2, "Dwelling Houses—A Code of Suggestions for Construction and Fire Protection," published by the National Board of Fire Underwriters.) The supporting beams under the floor, whether steel or wood, must be protected; the former by two inches of fire-proofing and the latter by at least one-half inch of metal lath and plaster, plaster-board or one-quarter inch asbestos mill board.

5. In dwellings of Type III where it may be impossible to secure a high degree of perfection afforded by a fire-proof floor for a cellar cut off, * * * it is still very essential that efficient temporary protection be provided and that every precaution be taken to prevent a cellar fire spreading to floors above, at least long enough to afford reasonable time to subdue it. This can be accomplished by protecting all communicating openings as elsewhere provided, and by covering the ceiling with fire-resistive material.

For regulations governing use of wooden joists or floor beams, see Part 4, Sec. 28, "Dwelling Houses—A Code of Suggestions for Construction and Fire Protection," recommended by the National Board of Fire Underwriters.

The best results in ceiling covering, when the floor is not concrete will be obtained by the use of portland cement plaster on metal lath. As an instance of the protection afforded the rest of the house by proper basement cut-off, may be cited the case of a residence in Youngstown, Ohio, in which a fire started in a pile of wood in the heater room and was held in check in the basement by portland cement plaster over metal lath, until it was put out by the fire department.

In the City of Chicago from September 1, 1918, to April 1, 1919, there were 237 fires in coal bins of houses and apartments, which were reported to the Fire Marshal's Office.

ROOFS

The same Bulletin contains the following regarding approved roofing:

1. Wherever possible use the fire-resistive roof covering. The safety which it offers is well worth the additional expense. There is a variety of approved

roofings on the market which will afford satisfactory protection and service. A number of them are but little more expensive than first-class wooden shingles. The first costs of a roofing material must be averaged with the years of service it will render in order to ascertain the real expense of maintaining the construction. The life of the best fire-resistive roofing is considerably longer than that of the wooden shingle and this fact should be considered in selecting.

Among the recommended roofings may be included monolithic reinforced concrete, concrete roofing tile and cement asbestos shingles.

2. The fire resistance of ordinary roofs can be considerably increased by covering the rafters on the under side with metal lath and plaster, asbestos mill board or asbestos building lumber, gypsum plaster board or any other incombustible heat insulating material. Such coverings add much to the comfort of a house by making the attic cooler in summer and warmer in winter. The insulation can be further improved by a two-inch layer of mineral wool placed between the rafters and supported by any of the board materials above mentioned:

Wooden Shingle Roofing

1. The great danger of the wooden shingle roof is from chimney sparks or flying brands from burning buildings. Wooden shingle roofs in combination with chimneys, defective or otherwise, have probably been accountable for more dwelling house fires than any other defect in construction or equipment. Records show that they are responsible for over twenty per cent of all fire losses in dwellings. The wooden shingle has also been justly called a "Conflagration breeder," for experience has shown that many of our large conflagrations have been spread and rendered uncontrollable by the flying brand hazard of this material.

CHIMNEYS, FLUES, SMOKE PIPES AND FIRE PLACES

The U. S. Bureau of Standards Circular No. 75, has the following to say regarding chimneys and flues:

"One of the serious fire hazards is that due to defective chimneys and flues. Good construction will minimize this hazard and will render the formation of cracks later, due to vibration, loading, settling or expansion and contraction, less likely."

The National Board of Fire Underwriters makes the following recommendation regarding the use of portland cement mortar:

"Portland cement mortar only should be used in the construction of chimneys and flues. Portland cement mortar is very superior to lime mortar in resisting the action of heat and flue gases. The latter disintegrates in time and is liable to fall out of the joints, thus producing a hole thru which a fire is likely to originate. Some building laws specify that cement mortar can only be used for the foundation of the chimney and the portion exposed to the weather above the roof. This is unwise; for reasons stated above the whole inside of a chimney exposed to heat, should also be built with cement mortar."

Dwelling house chimneys should have walls at least 4 inches thick and be lined with a suitable flue lining. In monolithic concrete chimneys this flue lining will serve as an inside form. If chimneys are not lined they should be not less than 8 inches thick. It is recommended, however, that lined chimneys of such thickness be used in localities subject to severe winters and where continuous hot fires are a necessity. A concrete chimney should be reinforced in both directions, otherwise it is liable to crack through temperature stress or unequal settlement of foundation.

Not more than two flues should be permitted in the same chimney

space, and the joints of the two sets of flue linings should be offset at least 6 inches.

The joints on the inside of all chimneys and flues should be struck smooth.

All chimneys should be built from the ground up and all their weight should be carried by their proper foundations. Foundations for exterior chimneys should be started well below the frost line. Connection between chimney and roof should be made with sheet metal flashing arranged to overlap and allow for movement that may occur between chimney and roof.

"No wooden beams or joists shall be placed within 2 inches of the outside face of a chimney or flue, whether the same be for smoke, air or any other purpose. No woodwork shall be within 4 inches of the back face of the wall of any fireplace. All spaces between the chimney and wooden beams shall be filled with some porous incombustible material such as mineral wool cinders, etc., this material to be supported by metal set into chimney and nailed to the wooden beams or flat metal nailed to the woodwork with the inner edge close to the chimney.

Under no circumstances should wood studding or furring be placed against any chimney. The wood construction should either be set back from the chimney or the plastering applied to self furring metal lath or directly on the masonry itself. Use of wire loops embedded at proper intervals in chimney wall is advocated for fastening lath and furring in place of nailing."

The National Board of Fire Underwriters says:

'The practice of inserting wooden joists in the wall of a chimney, or of placing studding, furring or other woodwork in contact with the wall is very risky, and should not be permitted under any circumstances."

Smokepipes are almost as important in point of installation and maintenance as chimneys because of the danger of fires from defective smokepipes. They should always enter the chimney horizontally and the connection through the chimney wall to the flue made with round tile or metal thimbles set in portland cement mortar. In monolithic concrete chimneys the connection should be cast with the chimney. Close flue holes when not in use with tight fitting covers.

No smokepipe should be within 9 inches of any woodwork, and where wood or coal are used as fuel it is better to provide a greater distance. Smokepipes should not be permitted to pass through floors, nor through closets or other concealed spaces, nor through a roof having wooden framework or covering, nor should such a pipe enter a chimney in the attic or garret. Every smokepipe should be cleaned at least once a year.

The construction of fireplaces is important, particularly the thickness (never less than 8 inches) and lining should be of fire brick. Trimmer arches supporting the hearth should be of reinforced concrete not less than 4 inches thick.

HEATING AND LIGHTING EQUIPMENT

Many of the fires in dwellings start through improper protection of the heating and lighting equipment. The recommendations of the National Board of Fire Underwriters covering heating and lighting equipment in the code of suggestions already referred to, should be followed as they may apply to the construction of houses of the various types that have been described.

The Committee recommends that in dwellings of a character to warrant the additional expense, all heating, ventilating or other service equipment should be separated from other portions of the building by a 5-inch concrete wall; the ceiling also should be of portland cement plaster on a metal lath base.

FIRE STOPS

No one feature of house construction will contribute more to its safety in case of fire than efficient well placed fire stops. Their purpose is to delay the spread of fire and so assist in confining it to the story in which it starts. This protects life and affords a better chance of extinguishing the fire.

Fire stops are applicable principally to non-fireproof buildings, though they can be used advantageously in any type of building where openings exist that would act as flues to distribute heated air or gases from a fire in one part of the building.

Incombustible material is best suited for the construction of fire stops. Its use not only lessens the chances of defective workmanship, but as such fire stops are unburnable the possibility of a fire getting by them is considerably decreased.

Fire stops should be so located as to perform the function described in the dwelling recommendations of the National Board of Fire Underwriters, but instead of being held in place by wooden strips or boards and put in as an unimportant adjunct to the carpenter contract, we recommend that all fire stopping be put in a separate contract by providing that the fire stops be formed by a basket of metal lath filled with concrete.

Dwellings within 10 feet of non-fireproof buildings should have the walls behind eaves or cornices fully fire-stopped to prevent fire from a nearby building breaking through into the attic space. This also protects against fire which might lap up under the eaves through the windows.

Incombustible cornices should be used. If impossible, metal lath and portland cement plaster or stucco should be used on underside of cornices.

Space between stair carriages should be stopped by a header beam at top and bottom. Where a stair run is not all in one room, or where a closet is located under the stairs, the stair carriage should have an intermediate fire stop, and the under side should be covered with portland cement plaster on metal lath.

Ducts, chases, or shafts for pipes, wires, speaking tubes, and similar details, should be firestopped at each floor with mortar to form tight joints. All exposed pipes passing through any floor or wall should have the surrounding air space closed off at the ceiling and floor lines.

COMMITTEE ON FIRE PREVENTION

Walter A. Hull, *Chairman*, Washington, D. C.
J. E. Freeman, *Secretary*, Chicago
E. G. Barnett, Cleveland
Wharton Clay, Chicago
C. W. Hejda, Chicago
W. C. Robinson, Chicago
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THE CONCRETE HOUSE AND ITS STATUS AS REGARDS BUILDING CODES

By Fred W. Lumis, Building Commissioner, Springfield, Mass.

Almost without exception, every man is interested in the subject of house building. But this unmistakable interest is only the beginning. The house must be designed and built, and our interest must evolve into action. At the very start, we decide what kind of a house we are going to build, and choose our building material. On this choice, as well as on the quality of workmanship, much will depend.

By studying the art of house building, we discover that the most successful houses do not depend upon ornament nor any particular kind of material for their success, but rather upon good lines, simplicity, and reasonableness.

Any building worthy to be called a house should be built of enduring material, and with proper care should serve three or more generations. Whether the material is wood or concrete, the thought of durability should always be engrossing if not paramount.

Much time and thought have been given to the study and examination of building materials. All have their virtues, their limitations and defects. But we are now considering the house of concrete.

Before a house or other building can be erected in any of our cities, an application for a permit to build must be made, a plan must be filed, also a written statement describing the character, materials, use, and location of such building—all showing the purpose of the builder to comply with the requirements of the state and local building laws.

Let us examine briefly the building laws or codes of some of our larger cities, so as to learn, if possible, their various regulations and restrictions as they apply to and affect the concrete house.

I have tried to condense a dozen typical existing codes, retaining only the salient features, reducing them to their simplest terms, and recording their actual mandatory requirements.

Only high grade Portland cements are considered in any of the building codes referred to.

An accompanying table will help to visualize the differences in requirements of the cities chosen for comparison.

In designing the concrete house, safety and economy must be reconciled.

If to embed the steel reinforcement $1\frac{1}{2}$ or 2 inches is sufficient to protect it from fire in a storehouse, or other commercial building, where large quantities of inflammable materials are housed, then $\frac{1}{2}$ inch of fire protection should be enough when the steel is embedded in the concrete walls and floors of a small house where none of the rooms would contain more than a few armfuls of combustible furnishings.

Where crushed slag is procurable, it might well be substituted for crushed stone in concrete for use in dwelling houses.

Cinders are variable in their structural and chemical properties, but their use in construction work in small buildings might be permissible in localities where other material is difficult to procure, or where they can be obtained in a relatively uniform and clean condition. They should be crushed and screened and free from ashes.

Building codes should require every maker of concrete block to have a suitable building or enclosure for protection from cold, heat, winds and weather, where he shall properly make and cure his block. Licenses should be issued to all blockmakers, such licenses to be revocable for causes set forth in the code.

In considering the codes which I have mentioned, it will be observed that the requirements are general and not specific. Alike to the warehouse a thousand feet long, and to the cottage—with partitions serving as diaphragms, extending in all directions, tying and bracing the whole structure every few feet.

The vertical supports and walls in large structures are designed principally with respect to their compressive strength, but the designer of a concrete house is not permitted to utilize any such economies.

As an illustration, a good reinforced concrete house, having horizontal dimensions of 30 by 40 feet and an average height above the basement of 20 feet, would weigh, including outside walls, floors, partitions and roof, approximately one hundred and fifty (150) tons, and if all the floors were loaded to their full carrying capacity of 40 pounds per square foot, it would add about 50 tons more. The weight of the whole building above the basement, together with its live load, could be safely supported upon one well designed concrete column, 23 inches in diameter. In the vertical supporting members in a typical concrete house, there is material sufficient to make twenty-five such columns.

Now this is extravagant designing—an unnecessary waste of valuable material. The designers are not encouraged to apply their inventive genius or even the best of their training and experience, but in many cases are restrained and handicapped by the requirements of existing building codes—codes that are influenced by other codes, which in turn are influenced by older and different methods of building. There is no logical reason why concrete construction should be measured in multiples of 4, 8, or 12 inches—just because brick and stone are figured that way.

Portland cement concrete is a comparatively new material, and new uses for it are being discovered every day. Until very recently, the concrete house was designed on the same lines and with the same details as a brick or stone house. And it was but natural that existing or incongruous building regulations should be applied to it.

But we are progressing. The engineers have led the way, showing us how to build with concrete scientifically and safely. The factor of safety can be very greatly reduced when ignorance, dishonesty, and carelessness are noticeably reduced, and better controlled.

The men who are really responsible for our building codes have worked to get away from archaic methods, have had to oppose ignorance, perversity, and entrenched interests. They have had to arouse and

BUILDING CODE REQUIREMENTS

City	Steel Stresses per sq. inch		Concrete Stresses per Sq. Inch			Concrete Mixture	Thickness of Walls	Miscellaneous
				Compression				
	High Carbon	Mild	Extreme Fiber	Mass Concrete	Columns			
Boston	16000		500	350	600 vertical and hooped rein.	1:2:4	Basement—12″ 1st and 2d stories—8″	May use cinders in fipor slabs, roof or filling
Bridgeport	16000	14000	600	450		Must Withstand 2000# at 28 days	Not less than 12″ or same as brick	Slag or clean furnace clinkers permitted
Buffalo	16000	16000	500	350		1:2:5	Same as brick	
Chicago		18000	35% of ultimate crushing strength	20% of ultimate crushing strength		1:1:2—2900* 1:1½:3—2400 1:2:4—2000 1:2½:5—1750 1:3:7—1500	Same as brick	Cinders permitted except in bearing walls, columns or piers
Cincinnati	16000	16000	600	500		1:2½:5	Reinforced—not less than 4″ Reinforced basement walls—12″ 1st and 2d stories—8″	Cinder concrete in floor arches or slabs only
			700	600		1:2:4		
			800	700		1:1½:3		
Detroit	18000	16000	650	450		Walls, beams and floor—1:2:4Columns 1:1½:3	Reinforced—66% of that required for brick. Plain—Same as brick	Slag permitted in walls and slabs. Boiler cinders prohibited
Hartford	80000 (ultimate)	60000 (ultimate)	800	500	850 hooped rein.	1:2:4	For houses: Basement—12″ 1st and 2d stories—8″	1:2:4 cinder concrete allowed at 50% of values given.
Los Angeles	16000	16000	650		800 hooped rein.	1:2½:3½ crushed rock	Reinforced—not less than 8″ Plain and block—same as brick	
			520	350		1:3:4½screened gravel		
				250 no rein.		1:7 bank or river gravel		
Louisville	16000	16000	650	650	450—vertical rein. only 540—hoops only 650—1 to 4% vert. rein. and hoops	1:2:4	12″ 1st story of one-story bldgs.—9″ Hollow block—10% less than brick or monolithic	Cinder concrete prohibited for construction work or fireproofing
Minneapolis	16000	16000	650	500† 208‡		1:2:4—must stand 2000 #	Basement—12″ 1st and 2nd stories—10″	Cinder concrete not considered
New York	20000	16000	650	500 (plus 900 on vert. rein.)		Reinforced—1:2:4—must stand 2000 # at 28 days. Plain—1:2½:5	Basement (rein.)—12″. 20′ walls—8″ 1st 10′ of 30′ walls—10″	Cinders permitted in floor slabs, reinforced partitions 4″ thick and plain partitions 5″ thick
Philadelphia	16000	16000	650 300 for cinder concrete	500 Plain walls or large piers—250		1:2:4— must stand 2000 # at 28 days	Reinforced—66% of that required for brick Block walls (1:2:3 mixture)—same as brick	Cinder concrete permitted in slabs and minor partitions—mixture 1:2:5; to stand 800#at 28 days.
Portland, Oregon	16000	16000	650	400			Same as brick	Cinder concrete not mentioned
Rochester	20000	16000	650	650	450 with vertical rein. only	1:2:4 must stand 2000 # at 28 days	Block—basement 12″—1st, 2d and 3d stories—8″	Cinder concrete permitted for floor slabs and fireproofing
St. Louis	20000	14000	800	500		Reinforced—1:2:4 must stand 2000 # at 28 days Plain—1:3:5	Same as brick	Hard burned clay aggregate—stresses 50% of those for stone concrete

*Crushing values of respective mixtures.
†For 1:2:4 concrete. ‡For 1:3:5 concrete.

Cities differ in detail of inspection and other parts of codes.

Hartford requires that a plant making block material must be in full operation when official tests are made and that the names of the owners of said plant must be placed on file with the Building Department. Block (1:3:4 mixture) must stand 1000# per sq. in. at 28 days. Allowable working load is 90# per sq. in. They require a license to make blocks and the license may be revoked for causes. The same license regulations hold at Portland, Ore., but block must be 1:3 (sand) or 1:3:5 (crushed rock and gravel) and must stand 2000# at 30 days.

Los Angeles requires the inspector to stop all work not within the requirements of the ordinances or be subjected to fine and imprisonment.

Minneapolis demands that designers of concrete buildings compute the dead and live loads and indicate same on drawing.

Philadelphia approves of reinforced concrete for all types of buildings whereby the design conforms to the requirements of good engineering practice.

For reinforced concrete New York demands that aggregate be screened crush stone or gravel, but aggregate for mass or plain concrete may be granite, trap rock or gravel.

Rochester, N. Y., demands that the Building Superintendent keep a detailed record of every operation including the date of removal of forms and file record with Building Department.

St. Louis makes no provision for block.

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mould public opinion, and receive its sanction before they could establish and maintain necessary reforms or enact building codes.

With a slight improvement in the intelligence and reliability of the average man, and a better and more universal understanding of the proper treatment and behavior of concrete in all places and under all conditions, great economies both in material and manipulation can be effected, and satisfactory results obtained.

Our building codes are primarily written and enforced for the dual purpose of protecting human life and the prevention of fire. They must occasionally be revised, so as to comprehend new materials and new methods.

The concrete house of various types will gradually and shortly come to be considered on its own intrinsic merits, and building codes will contain provisions that will be specially applicable to such houses.

The concrete house, with its unlimited opportunities for style, finish and decoration has a value and a charm all its own. The designer should bear in mind that he is expressing himself in terms of concrete, and also that it is a medium worthy of his best thought and his noblest effort.

A reinforced concrete residence at Jacksonville, Fla. Schub system molds were used.

Substantial, well-designed, concrete residence of W. G. Higgins, Brookline, Mass.

REPORT OF COMMITTEE ON MONOLITHIC CONCRETE HOUSES

Nearly fifty years ago the first monolithic concrete house was constructed in the United States. This house is in use today and gives every evidence that the end of the next fifty years will find it in the same condition as today. Whatever its cost may have been is insignificant when spread over the half century of useful service it has already rendered and will doubtless continue to render for years to come. No doubt, this house cost more to build than a frame house would have cost, but *ultimate* economy which includes the cost of maintenance, repairs and depreciation, tells a story quite different from first cost. The lowest priced article is often not the cheapest in the end.

A house must be habitable and therefore comfortable. It must protect its occupants against heat and cold. It must be sanitary. Its appearance, while secondary from a purely utilitarian standpoint, must not violate the principles of architecture and harmony with surroundings and proportion. But "A thing of beauty is a joy forever" is true only if the thing lasts indefinitely. This means that the structure should be permanent.

Utility is obtained by proper planning for the use of enclosed space. The concrete house allows this without interfering with architectural treatment. By employing a "dead" air space in the walls insulation against heat and cold is obtained. Concrete is strong and permanent. It does not rust, rot or decay. The question then remains as to how it may be utilized in a practical way in the construction of homes.

The fundamental problems to be solved in practical monolithic concrete house construction are forms and design, and field practice.

Forms and Design.

A monolithic house of any architectural design, form or size can be built, but in order that the cost of construction be held within reasonable limits the forms must be susceptible of repeated use. This requires either that the same set of forms allow wide variation as to length, height and relation of surfaces or that the design itself be limited to the flexibility allowed by the particular system of forms employed. There is no system of concrete house molds available that does not require a certain degree of standardization in design to make their use economical. Gables, bay-windows, curved surfaces or other than right angled corners add to the cost of form work.

For a large group of houses, which is essentially the industrial housing problem today, much emphasis has been placed on appearance. Rows of houses of identical design are often condemned, and rightly so, if each individual house is ugly, whether built of wood, brick or concrete. There is little choice, however, between a group of houses all different but each of which is ugly and a group of ugly houses all alike excepting that the ensemble of all different ugly houses is more offensive than the group of all alike ugly houses. It does not appear that a group of houses each of which is pleasing will present an unpleasing

A progress report of concrete house construction, 1880-1920. Above, a recent photograph of a group of concrete houses in Allentown, Pa., built in 1880 and still in service. Below, modern, monolithic concrete cottages built with Lambie forms at Manhattan Beach, L. I.

ensemble even though they all have the same general dimensions. Thus the problem is at once solved by producing a correct architectural design as to general style and proportion which can readily be altered in minor details such as, the entrance, porch and roof, without at all affecting the pleasing architectural proportion. This is the work of the architect and offers a challenge to his talent and genius.

Design for a large project must above all other things be practical and must therefore meet all the real needs of the occupants. Large groups of industrial houses will, in large measure, be occupied by a fairly uniform class of families. Different grades of workmen or different nationalities usually require separate groups with corresponding differences in size or design of house. Within each of these sub-groups there is little reason for much variation in the main dimensions or floor plans of the houses, and the objection of sameness is at once removed by a skillful arrangement of houses with variations in roof and porches, surface treatment, location of entrances and the facing directions of their fronts. This has been amply demonstrated in a number of recent industrial housing developments, and the fact that the monolithic house has practical limitations as to variety because of the use of forms should not hinder the adoption of this type. Too often the monolithic house is discarded as soon as the half truth is suggested that they must all be alike, when as a matter of fact, a little skill will completely dispel all appearance of monotony and if the general design is good, the group will be attractive.

The molds that have been developed and used may be classified as to material—wood and steel. Among the most widely known modern concrete house molds are those invented by C. H. Ingersoll and used to build the concrete houses at Phillipsburg and Union, N. J. These molds do not permit of much variation in design and a complete separate set is required for each type of house. The molds produce a solid wall, which is furred, lathed and plastered to furnish the insulation required.

Another system of wooden forms utilizing grooved 2 by 4's which support and hold in place sectional wooden forms is known as the Felligren System.

The best known systems of steel molds are the Hydraulic Steelcraft, Morrill, Lambie, Metaform, Blaw-Knox, Schub and the Van Guilder. The Steelcraft, Morrill, Metaform, Blaw-Knox and Schub molds are made up of relatively small plates from 2 to 3 feet square. The Lambie forms are composed of steel channels set vertically, clipped together at the flanges and lined with horizontal liners composed of steel angles. The Van Guilder molds represent a different type consisting of a combination of plates about 9 to 18 inches high, held together by yokes and released from the wall by levers. When the chambers of the machine are tamped full of concrete the plates are released and the machine moved ahead, traveling around the wall and forming a course from 9 to 18 inches high. This method produces a double wall and obviates the need of furring and does not impose restrictions on design.

Field Practice

The total amount of concrete required for a concrete house is relatively small and does not justify heavy and elaborate equipment. A

Residence of reinforced concrete, Port Chester, New York, built by W. E. Ward in 1872, and still in excellent condition.

Concrete residence of Wilson D. Lyon, Glenridge, N. J., built with Van Guilder forms.

small one-bag batch mixer will mix the concrete in sufficient quantity and sufficiently rapidly and where construction is on a large scale with many houses going up at once, several small mixers are needed rather than one or a few large ones. For the construction of two-story houses, some separate means of elevating the concrete is necessary unless elevating machinery is a part of the mixer outfit such as the Humphrey conveyor equipment. George E. Lewis of the Marion Double Wall Co., Marion, Ohio, has solved the elevating problem as required by the Van Guilder wall machines by using a small portable lift which carries a flat platform wheelbarrow loaded with pails filled with concrete. This lift consists of two guides built up in interchangeable sections bolted together and held in position by staying to the floors. Where it is impossible to put the lift inside of the building, it has been used outside by using a few extra stays. Collapsible scaffold horses carry plank runways on which the barrows are wheeled to place.

The mixer should have a hoisting drum attached to operate the lift and should be sufficiently open to be easily cleaned. The hoisting attachment is usually added to standard mixers as a special appliance.

Construction of the one hundred concrete houses at Donora, Pa., was started with a high tower, but the tower was dispensed with later and small mixers and hoists substituted with better results. A small mixer was placed alongside each house during concreting. The concrete was handled in buggies, lifted by circle swing derricks.

In building concrete houses at Long Island City, N. Y., a 50-foot mast and mast hoist bucket plant was used. Concrete for ten houses was placed at one setting of the mast which required but a few hours to move.

The plant handled about seventy yards per day with a crew which consisted of one foreman, three men wheeling aggregates, one man handling cement and water, one hoisting engineer and three men tamping and handling chutes.

In building the Van Guilder houses at Youngstown, Ohio, a ¼-yard mixer was used and the material conveyed in buckets on platform wheelbarrows operated on runways up to the second floor level. The buckets were passed up by hand for second story walls. The crew consisted of 8 men up to the second floor, and 9 men for the second story.

Surface Finish

There are two general ways of obtaining surface finish,—(a) application of coloring to the concrete surface after the forms are removed, and (b) treatment of the surface itself either before or after the forms are removed. Color may be applied directly to the concrete surface either as stucco or paint. Stucco may be made in many shades and a considerable range of color is also offered by special paints suitable to concrete surfaces. A machine for applying stucco has lately gained considerable attention. Stucco, applied directly to the concrete surface without the use of lath or fabric of any sort will be permanent if the work is properly done, and freshening of the surface to restore the color may be done by the simple proces of washing with a hose and scrubbing.

Surface finish obtained by depositing colored aggregate or color-

ing material in the forms next to the surface or by mechanical means, such as tooling, sand blasting, etc., or a combination of these will usually cost less than stuccoing and will produce a permanent finish. The variety of color effect is, however, much more limited than is obtainable with stucco.

Interior Construction and Inside Finish

The truth should not be lost sight of that the monolithic concrete house in which concrete has been consistently used in walls, floors, partitions and roof *does* represent the highest type of firesafe, permanent, maintenance-free house.

It is universally admitted that concrete floors are fireproof and sanitary. There is, however, a marked difference of opinion as to the desirability of a concrete floor surface from the standpoint of comfort and coziness.

Wooden floor surfaces are applied either by embedding nailing strips in the concrete or by covering the structural concrete floor with a mixture of cement mortar and sawdust or cinders to which the wooden floor covering may be nailed. The best solution of the concrete floor problem is the use of easily removable floor coverings of carpets, rugs, linoleum or patented floor coverings. Inserts for buttoning down floor covering may be embedded in the concrete. The covering is easily removed and the floors may be flushed and scrubbed.

Solid monolithic concrete walls are no exception to other masonry walls in regard to the requirement for insulation to prevent condensation of moisture on their interior surface. Furring, lath and plaster should be used to produce an air space between the concrete wall and the surface of the interior finish. For this purpose wooden nailing strips or plugs to which the furring may be attached should be embedded in the concrete wall, or wires or "hairpins" allowed to protrude from the concrete for the attachment of ribbed metal fabric or wire mesh. Whatever detail is adopted the fundamental requirement of insulation must be provided—a "dead" air space must be obtained or some insulating material used between the concrete and the inside finish.

Partitions in an otherwise fireproof house should also be fireproof. In monolithic houses of the bearing wall type with concrete floors it is usually economical to make some of the partitions heavy enough to carry the floor loads, thus cutting down the floor spans and obviating the use of deep beams. These partitions are then similar in construction to the exterior walls. Furring is omitted and the finish applied directly to the concrete surface. Partitions that do not carry floor loads may be constructed by plastering and back-plastering on ribbed expanded metal or mesh. Openings in such partitions may be secured by using pressed steel or concrete studs each side of opening. Plastered partitions may be made to form a dead air space by constructing two walls a few inches apart, both plastered on expanded metal or mesh reinforcement.

In order to carry out the idea of firesafeness completely the roof must be incombustible. If the ceiling of the top floor is concrete and the roof covering is tile, slate or asbestos shingles, the roof framing may be of wood without appreciable increase of fire hazard from without.

If the top floor has a concrete ceiling the extra expense of a wood frame roof can be justified only because of architectural effect and some additional protection from heat and cold. The concrete ceiling may serve at the same time as a roof. Much difference of opinion exists in regard to the appearance of a flat roof. It is certainly true that many high class residences have flat roofs. Both flat and pitched roofed houses were constructed in the Cranwood Development, and the flat roof houses were the first choice of the purchasers. A concrete pitched roof built with forms is more difficult to construct than a flat one. A concrete pitched roof can, however, be constructed by plastering or shooting with a cement gun on expanded metal or mesh reinforcement.

Fellgren System, monolithic concrete residence of Adolph Boericke, Chicago.

CONCLUSIONS

1. The work of this Committee should be continued and new members added to it.

2. Concrete, being different from other materials used in home building, presents new problems and new limitations in design. These must be studied in order to produce artistic effects economically.

3. When houses are built in groups having the same overall dimensions, good architectural design can be given sufficient variety to remove appearance of sameness by using colors, by methods of surface finish and by skillful arrangement of roofs, balustrades, cornices, porches, etc. Irregularity of design, bay windows, curved surfaces, cornices or oblique angles are not necessary to good appearance of a large group of houses.

4. Thickness of walls of monolithic houses is governed by considerations of field practice rather than by the requirement for strength. Building regulations should recognize the great strength of concrete and therefore the thickness of walls should be governed by the requirements of standard engineering practice. The thickness in the basement

need not exceed 8 inches and in first and second stories 6 inches. Where Hollow Wall Construction is used the same total thickness of concrete is sufficient.

5. Well constructed 6-inch concrete walls require little reinforcement for structural reasons and do not need more than $\frac{1}{4}$ of 1 per cent to provide for temperature stresses. A proper mix for these walls is about 1:2½:4 with maximum size aggregate about 1 inch. Broken stone, pebbles or a good grade of slag or cinders may be used as coarse aggregate.

6. In climates subject to sudden and great changes of temperature, a dead air space throughout the exterior walls must be included within the wall proper or an air space must be formed by furring and plaster or some insulating medium used between the solid wall and the interior finish.

7. Complete firesafeness requires concrete floors and partitions and an incombustible roof.

8. If a concrete floor is finished in cement it should preferably be covered by rugs, carpets, linoleum or special floor coverings that are easily removed.

9. A thin stucco coat has been found a satisfactory method of finishing exterior concrete surfaces. Finishes have also been obtained by exposing colored aggregates and by tooling, sand blasting or rubbing. Troweled finishes are not recommended.

10. Small, one-bag batch mixers and simple elevating equipment of the mast and bucket or two legged tower and skip type are best adapted to monolithic house construction.

11. Window and door frames can be set in the forms and the concrete cast around them. Wooden frames should be well primed as a protection from moisture in the concrete. Frames should be anchored to the concrete by means of long spikes or bolts. They should be braced against distortion from the pressure of the fresh concrete.

12. Forms should be light enough or in sufficiently small sections to allow handling by the form setters without producing undue fatigue. They should be capable of positive alignment both vertically and horizontally.

13. The monolithic house offers an unlimited field for development. Encouragement should be given to the development of all systems of forms that have proven practicable for the construction of monolithic houses.

14. The monolithic house offers advantages in speed of construction that makes it especially suitable for large Housing developments.

COMMITTEE ON MONOLITHIC CONCRETE HOUSES

Leslie H. Allen, *Chairman*, Springfield, Mass.
A. C. Irwin, *Secretary*, Chicago
F. M. Coogan, Easton, Pa.
George E. Lewis, Marion, Ohio
H. B. Loxterman, Pittsburgh
Milton Dana Morrill, New York
John J. Porter, Hagerstown, Md.
R. D. Spradling, Cleveland
K. H. Talbot, Milwaukee
Harvey Whipple, Detroit
Capt. Alan P. Wilson, Roanoke, Va.

REMARKS.

P. R. SMITH: On the work of the Phillipsburg Development Corporation we started out with frame houses of the ready-cut type. Shortly afterward we started the monolithic houses, but we had a feeling they were not going to be successful. The first houses to rent were the frame ones, but within a month after the first concrete houses had been completed, the people were all after them and would not rent the frame ones. There is a steady demand for the concrete house and we are going to continue to build them.

Wood forms are used in the Ingersoll System of construction. The forms are set up on the footings and cellar floors and the concrete is poured from the roof, making a real monolithic house. With a crew of from 10 to 14 men, as the situation demands, we can pour a house containing 12,500 cubic feet in 8 hours.

EMILE G. PERROT: How much reinforcing do they use in the walls?

P. R. SMITH: About 1,900 pounds for 80 yards of concrete, and the house cost about 22½ cents per cubic foot.

E. H. RAWLE: Were these houses of hollow wall construction? Also how were the outside and inside walls treated, and with what success?

P. R. SMITH: The wall is solid, as are the floors, partition and roof. The inside of walls was furred by using furring strips to which plasterboard was applied, followed by a plaster coat. Exterior walls were stuccoed with the exception of one instance, where we floated down the finish, thinking that we might be able to do it more cheaply, but we found this was not the case.

ALBERT E. KLEINERT: As Superintendent of Buildings of the Borough of Brooklyn, I am much interested in knowing whether it is possible to produce a cheaper building than we have so far been able to obtain. It is a question of economical construction, and the Ingersoll house seems to me to solve the problem. It is of reinforced cinder concrete. I understand that is a very good construction, and I have had my engineers go over the method of reinforcing, and found that with the exception of a little more being required, the construction was absolutely feasible, sound, and might be obtained at least 20 per cent lower than ordinary frame construction. Furthermore, taking into consideration the scarcity of materials and skilled labor, I think it is a good product and will open the door for developing small houses for small families.

There is no reason that I can see why we should pay $30 a thousand for brick and more, if the haul is a little longer than ordinary. I remember the time when I paid $6 a thousand for good brick, delivered on the job. Why brick must be raised 400 per cent I do not know. I would like to hear the howl people would make if laborers would ask 400 per cent increase in wages.

ALAN P. WILSON: My sole usefulness to this assembly lies in the fact that for about ten years I have been separating people from their money in selling steel forms. Many people do not seem to understand that there are available today commercially tested systems of steel forms capable of being re-used almost an indefinite number of times. A set of

forms which I sold in 1909 is in use today and last year was re-sold to a construction company now completing a grain elevator in Buenos Aires, South America. These forms had been used probably more than 700 times before they left the United States and were still as good as ever when they were shipped out of the country.

The first feature to be considered in connection with the steel forms is the number of times they may be handled to reduce cost of each use. Next, their type as to the kind of surface that can be given to the concrete, permitting suitable finish at reasonable expense. Settle those points and you have your forms. They must be so designed that they assemble properly and need the minimum of shoring and bracing. They must leave the surface sufficiently free from offsets where the panels come together that these surface defects will not show through a half inch of stucco. I can offer such a form and there are many others on the market also deserving consideration.

GEO. E. LEWIS: I would like to describe very briefly the Van Guilder double wall form. It consists of a small metal form which builds two separate parallel walls close together as easily as a thicker single wall. The form is provided with a quick releasing system which releases it from all sides of the two walls. Incidentally, the largest form weighs about 100 pounds, is 5 feet long and lays two walls 9 inches high. Either wall can be 3, 4, 5 or 6 inches thick. An average day's work for an ordinary operator and his gang is about 400 linear feet, although more can be accomplished by two men who have had considerable experience. As much as 1,000 linear feet has been laid in a day.

It has been the aim and object of the Van Guilder people to develop a system of concrete construction for building a double wall with a continuous dead air space at a cost not to exceed that of frame construction. The continuous air space secures the best possible insulation from changing temperature conditions and enables us to plaster and decorate directly on the inner concrete surface.

Walls are reinforced longitudinally and tied together by means of galvanized iron crossties. Placing of this reinforcement is accomplished by laying a course 9 inches high entirely around the structure, placing the crossties on this course, then laying the next course on top of the one already laid and repeating this operation throughout the entire construction of the building.

The system is flexible enough to follow the plans of the architect even though they may be intricate, but simple enough in operation to require only the minimum of skilled or high-priced workmen. It is not a new system, having been in operation for a number of years, and buildings can be found in all parts of the world that have been erected by using the Van Guilder forms.

C. D. MACARTHUR: We have had a form on the market for seven or eight years which we call a light building form. It is applicable to foundation work, for light retaining walls, for grain elevators, for any structure where light walls are used and which can be erected in heights of not to exceed 10 feet; that is, pouring 10 feet at one time. In that system we can use what we call the course outfit of setting up the forms 4 feet high and pouring 2 feet at a time, going up in lifts so the form

has a general application for light building construction as well as for floors, roofs, etc. There is a point of economy in the use of these forms. We sell them, but we also lease them to contractors. Where a contractor is doing general building construction, it is more economical for the contractor to equip himself with these forms and consider them a part of his plant, as he does the mixer or any other machine. We have customers who have as high as 50,000 square feet of these forms which have been in use for several years. The number of uses we can get from them, as Mr. Wilson says, is unlimited. One construction company has used a set in sewer work probably 300 times without any appreciable deterioration.

J. R. RICHARDSON: I have just built a house in California using a system of wood forms producing a hollow concrete wall. With this system you can go up a foot at a time or a story at a time, and I challenge anyone with any other system to build as cheaply and as quickly as I can and leave a hollow space in the wall. In the house mentioned, which is 10½ feet high, five men built it in 5½ days, actual working time. This included assembling and dismantling forms and pouring concrete. The actual concrete pouring took 9 hours.

A. H. OLMSTED: I am not in any sense representing the Lambie System of forms, but I think it should be mentioned because it has had considerable use. It is a story-at-a-time system, composed of units 6, 9, or in some cases 12 inches wide, so that by a combination of two 6's or a 6 and a 9, you can get any width of surface horizontally desired. The plates are so arranged that you can get any story height within measurements of 3 inches. The system is very flexible as to design. If you have 10 sets of forms, you can combine them all into one set. You can build a single house, a semidetached house or an apartment house. At Donora, Pa., 100 concrete houses were built using this system, and even under very unfavorable conditions the houses were put up at a cost that was estimated not to exceed cost of brick or hollow tile. I am not interested in the Lambie House Corporation, but feel that this system should be kept in use as I believe if we are going to build concrete houses, we should use every available system and not wait three or four years until what we think will be the perfect system has been developed.

A. C. IRWIN: Request was made for some information as to the methods of applying stucco to concrete surfaces. I should like to hear from those who have had experience with this work. I notice that in the report the Hodges stucco machine was mentioned. Are there any in the room who have used this machine to finish the exterior surface of monolithic concrete walls?

S. B. MOORE: I have not used it, but have seen the machine in use in Dallas, Tex. It applies some ½ or ¾ of an inch of stucco very substantially. The work to which I refer is being done by Klein Brothers of Dallas.

GEO. E. LEWIS: We used the Hodges machine on one large building in Marion, Ohio—a store building with offices, and secured very good results at reasonable cost, although we had some trouble with union labor, making it cost a little more than it should have. Two-coat work averaged about 70 cents a yard.

THE CHAIRMAN: As the Chair understands it, the question is, how can a thin stucco coat be applied except by the splash system? Can anyone answer that question?

S. B. MOORE: A thin stucco coat cannot be plastered directly on the smooth concrete wall. It will peel off. The only way you can get a good job is to roughen the wall. You can roughen the wall if you can spade the concrete so that coarse material comes against the form, so that when forms have been taken off you will have a surface with which the stucco coat will clinch.

MILTON DANA MORRILL: The proof of the pudding is in the eating. The application of a thin coat of stucco over comparatively smooth concrete has been done on hundreds of buildings notwithstanding the general opinion of its impossibility. Of the particular buildings of which I have knowledge, I have never seen a portion as large as a dollar that has flaked off, providing it was put on without too much troweling. As a general rule, on smooth walls we find that one coat gives the best satisfaction. If you apply stucco of too great thickness there seems to be more danger of cleavage. From my personal experience I have found that the thinner we can make our stucco, the better and more economical the results.

E. H. RAWLE: I would like to volunteer a few remarks based on practical experience in plastering concrete walls, not walls of houses. In the construction of a house we can't regulate the elements. We may get a hot sun one day, rainy weather or frost the next. Assume that it has rained or in some part the work has been held up and the concrete has hardened so that you cannot roughen the surface which should be done as soon as possible after removal of forms. Your stucco will adhere very easily if you can scratch the surface of the wall in this way. I believe with Mr. Morrill that the thinner the application the better and more economical. But if the concrete has stood so long as to harden, it can be roughened. But there is another method that I have used and possibly you are aware of it. A solution, consisting of about a teaspoon of muriatic acid to about a gallon of water, is applied to the concrete and allowed to act until the acid has lost its strength. After several hours the surface is flushed with clean water applied by a hose. The acid will have cut the cement coating the aggregate particles, giving us a fresh surface. If the weather is hot when the stucco coat is applied, it must be kept from drying out in some way for 48 or 60 hours. If that is not done there are certain to be fine cracks in the surface.

F. L. NORTON: Some things have been said about the cheapness of the monolithic house. I think we are in some danger there. I am a real estate man and have been subdividing and selling subdivisions for a number of years. Last year we built on one of my subdivisions 15 houses ranging in cost from $3,000 to $5,000. This year we expect to build double wall monolithic houses, but my argument is not going to be cheapness. "Economy" is the thing we want to look to, not cheapness. My argument will be, not cheaper, but better houses, and I think that if we keep that in mind we will avoid a great many of the mistakes that have been made in the past because many people confuse cheapness with economy. The monolithic double wall house is a comparatively

new thing and there would be danger in attempting to cheapen it. The result would probably be that in a few years people would look back to failures.

LESLIE H. ALLEN: I am particularly pleased with what the gentleman has just said, namely that the chief argument for a house of this kind is not that it is cheaper, but that it is good—better. That is the way people who have been selling concrete roads have talked about them. Before we get to midsummer we will be talking $6,000 for a six-room house with all improvements. We must get used to high cost. We are only misleading and fooling ourselves and attempting to fool the people by trying to talk low cost for concrete or any other material today. We must use the best material and consider it on its merits.

S. B. MOORE: I would like to tell you briefly of the experience of the Turner Construction Company in building an industrial village at Baytown, near Houston, Texas, for the Humble Oil Co. The great problem, as you all know, in an oil field is to get skilled labor. Derrick builders, who are just common carpenters, sometimes draw from $12 to $15 a day. The first thing the Turner Construction Company faced was a shortage of skilled labor. If they had attempted to use brick or hollow tile no one knows when they would have completed their job. So they ran across a product that had been developed in Houston, Texas, known as the Moore structural unit. This consists principally of 12-inch concrete channel which reverses to a jaw or trough at the top and which is designed so that when this jaw is poured with concrete in which suitable reinforcement is laid, the wall acts essentially as a monolith. The Moore structural system, as it is known, has been developed with particular reference to houses or other buildings up to three stories high. Specially designed units are also cast for floor construction. The Moore system eliminates expensive form work and a large amount of expensive labor, both of which items form a large proportion of the cost of concrete construction. The wall units are set up vertically. They are reinforced with four $\frac{1}{4}$-inch rods in the four corners of web and flanges and by stirrups of No. 9 wire on 2-foot centers. Nailing blocks are provided and are embedded in the flanges of the channels, securely anchored by nails or bolts. These nailing blocks are uniformly spaced and provide means of fastening furring strips. Briefly it has the following dominant features:

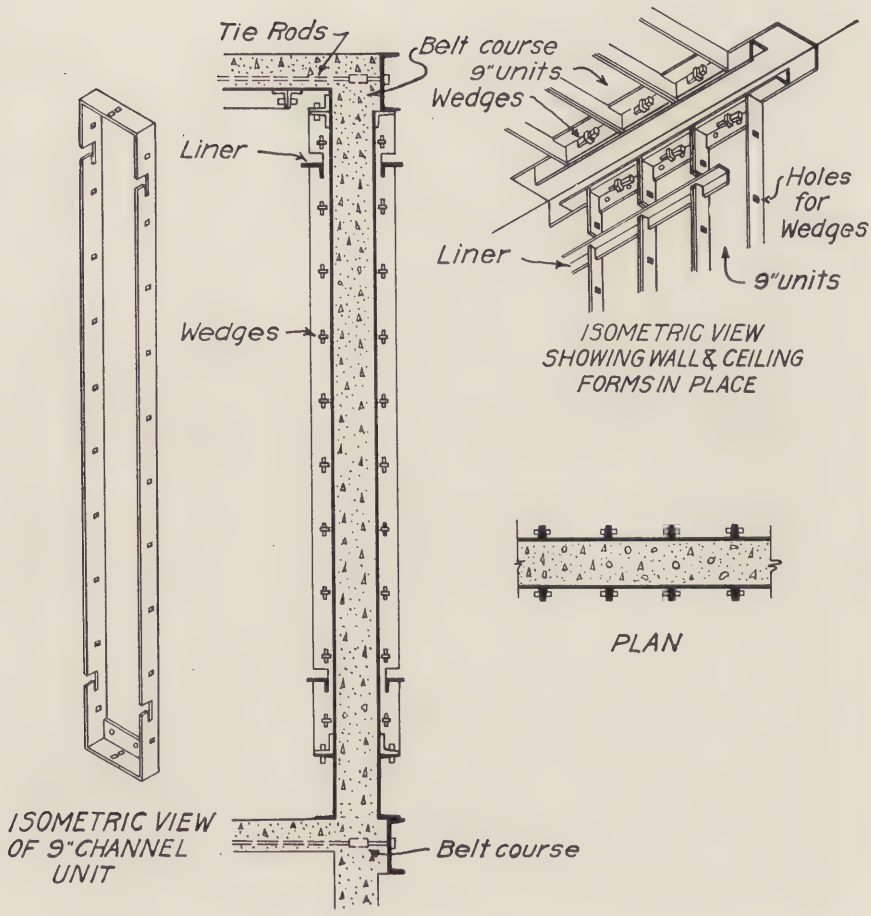
1. Each unit provides a large amount of air space. The completed wall contains a larger amount of air space than secured by any other similar type of construction.

2. The jaw or "U" opening in the upper end of each unit provides the form and space for the lintel beam around the wall at the top of each story.

3. Because of the beveling inward of the flanges of the units, there is formed in erecting them a wedge-shaped opening which provides a key wedge for stucco and insures a better bond of the finish stucco.

4. As cast, the outside face of webs are heavily scored, thus providing a perfect bonding surface for the finishing coat of stucco.

5. Cross sectional area of concrete is 35 square inches per linear



Lambie System. Detail of form units. Wall forms are also used to mold floors. Forms for one entire story are set up at a time.

foot of wall or per unit. This provides ample bearing surface to carry the wall loads of any one, two or three story building.

6. The cross sectional area of steel, which is .196 square inches per unit or linear foot of wall, provides ample steel to withstand stresses and with stirrups every 2 feet, each unit is made to act as a column.

It permits permanent and fireproof or highly fire resistive construction, walls absolutely free from sweating, and speed of erection at a low cost.

DESCRIPTION OF VARIOUS METHODS OF MONOLITHIC CONCRETE HOUSE CONSTRUCTION:

Lambie System:

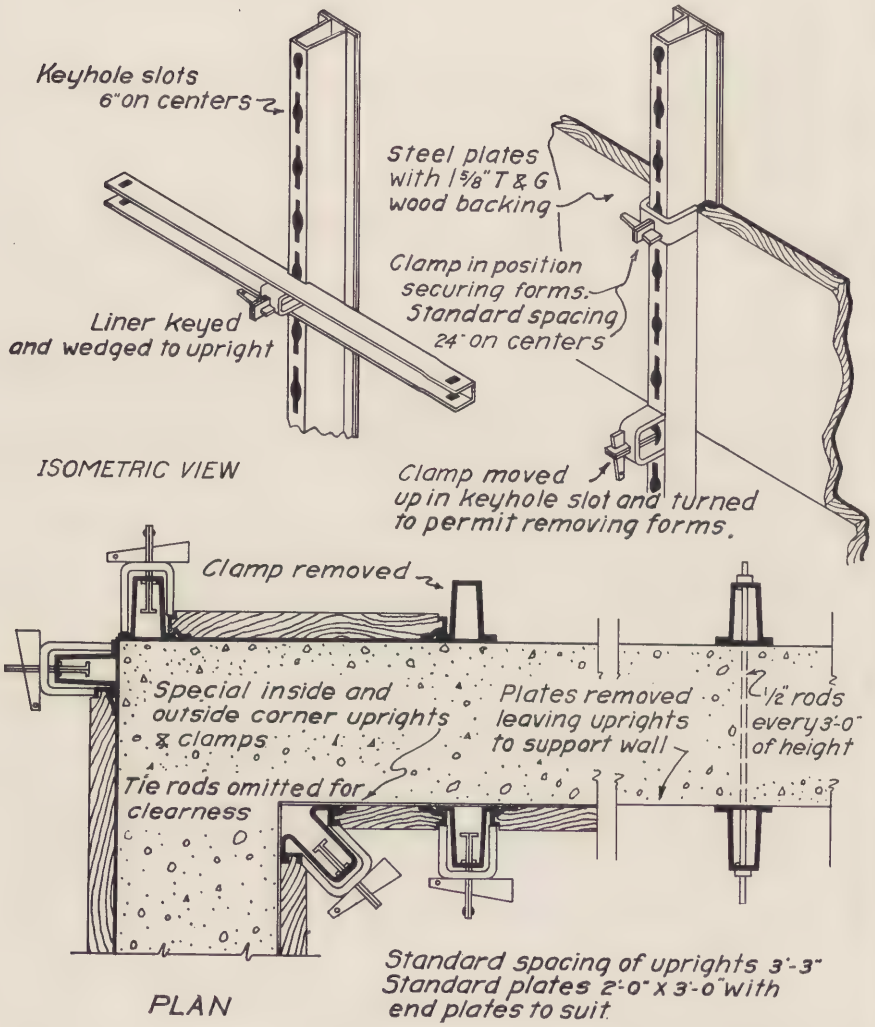
Lambie forms are manufactured from 6-inch shipbuilding channels and standard 9-inch channels of various lengths together with liner angles, release plates, inside and outside corners, collapsible floor forms and belt course.

The standard channel units are 7 feet 6 inches long, punched on flanges and on ends so that they can be clipped together in a horizontal or vertical position. Any dimension in multiples of 3 inches can be obtained by combining 6-inch and 9-inch units. Height of ceiling in multiples of 3 inches can be obtained by using the units vertically and horizontally and openings for doors and windows can be made at any point and of any size. Porches and areaways are formed with the body of the house.

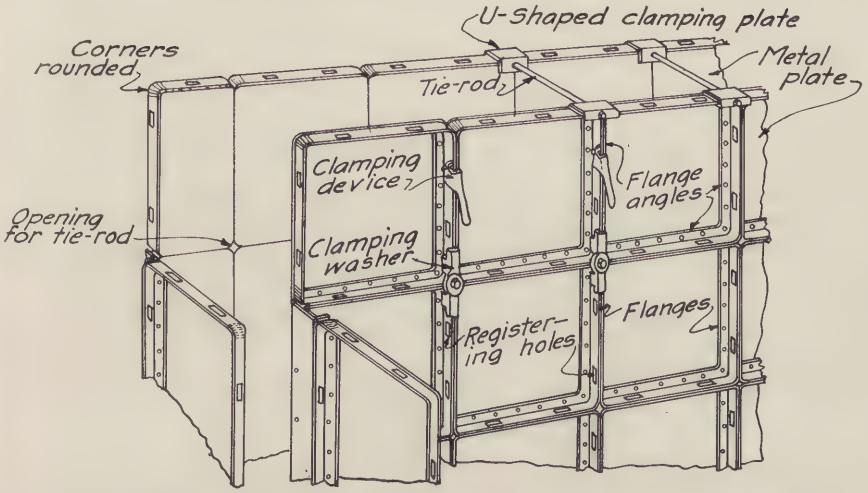
The individual channel units are secured to each other with clips and wedges. A special angle-iron liner is then inserted in the notches in the channel iron to insure a perfectly straight surface. At the same time as the wall forms are erected the forms for the floor or roof above are put in place. Then both side walls and floors are cast. When the forms for the basement are erected their tops are attached to a special member called the belt course, which holds the forms in place, and are cross-braced by steel rods extending from one side of the house to the other. These rods remain in place after floors are cast and serve as reinforcing for the floor. The belt course is also placed at the second story floor line and the forms used for first floor are used throughout the building by raising them from story to story. The regular channel units are used for forming the floors.

Hydraulic Steelcraft Forms:

These forms consist of light pressed steel U-shaped vertical liners and horizontal ribs supporting steel form plates backed with wood. The edges of the wood backing are clad with light steel plates. Keyhole



Hydraulic Steel Craft System. Details of forms. The clamps are easily placed or removed, facilitating the quick setting up or removal of the form panels.



Schub System. Detail of forms. These molds are quickly assembled and are secured by clamps on the flanges and by tie rods at the junction of four plates.

slots in the backs of the vertical liners enable the horizontal ribs to be clamped on by means of a key, wedge and U-clamp.

In erection, the framework of ribs and liners is erected and aligned. The plates may be left off while reinforcing steel is being placed or they may be removed at any point to give access to the forms for cleaning or other purposes. Floors and roof slabs are constructed by using the same equipment as for walls.

These forms can be erected with any labor available, as skilled labor is not required. No cutting or fitting is done. Forms are automatically spaced by the liners. All fastenings are of a quick acting wedge type which requires only driving up the wedge with a hammer.

No part is heavier than one-man size. With one set of forms an ordinary two-story six-room house with basement can be erected at the rate of one house every eight working days.

The Schub System:

The Schub System consists of a plurality of metal plates, generally square in form. These plates are flanged on all outer edges with angle-irons. To accommodate variations in length of structures, shorter plates are used, these being of the same height and construction as the common square molds. By setting these short plates or molds on edge varying heights can be obtained.

Flanges have two holes on each side, one located near each corner, matching corresponding holes in adjoining plates. Through any pair of holes the pin of a lever handled V-slotted clamp is inserted and when the handle is pushed down, the flanges of adjoining plates or molds are drawn tightly and firmly together within the V-slot of the clamp.

Sleeves, short lengths of pipe, slightly less than the width of the finished wall in length, are used to separate the inner and outer molds

and also permit bolts or rods to pass through for drawing the forms together. A cone-shaped washer is placed at each end of the sleeve, thus increasing the length to the exact width of wall desired. At the common corner of four mold plates the bolt is inserted between the rounded corners of the plates through the sleeve and clamping-washers placed on each end of these bolts. When the top tier of forms is reached a loosely placed U-shaped washer is placed over the end of each rod which locks or clamps the four plates together at the corner.

When forms are removed, the washers on the ends of the sleeves are pried out and the holes filled with cement mortar. When adapting plates to corner construction an angle iron is placed or fastened to the edge of the common square plate, thus turning the plate at right angles.

The Fellgren System:

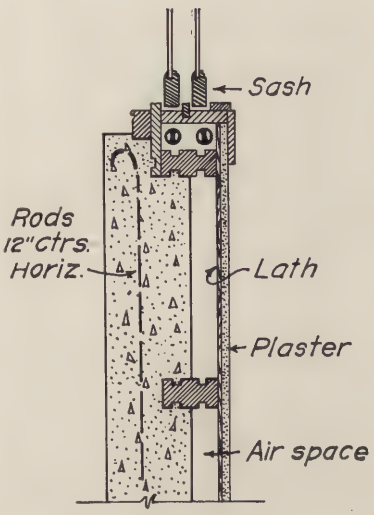
In the Fellgren System a framework is erected as for the ordinary frame construction. Studs are grooved on the 4-inch face and properly spaced for furring for lath. The grooves anchor the studs into the concrete and also support the inner mold boards, which occupy the space between studs. These mold boards are about square in shape and are held at any desired height by latches fitting into the grooves in the studs. The outer forms are built of one-inch lumber connected so as to form units by two stringers. These units are about two feet in height and any desired length, and are fastened to the studding and held at proper distance by lag screws and separators. After any layer of concrete has been placed and has become sufficiently hard, the lag screws are removed and the outer forms moved to the position immediately above. The holes made by the lag screws are filled with cement mortar when forms are removed. The walls are generally about 6 inches thick and 1½ inches of the studs extends beyonds the concrete on the inside face of the wall. This provides an air space between the concrete wall and the lath-and-plaster, which serves as insulation. The exterior surface of the concrete walls can be finished in any manner desired. In this system concrete work has so far been confined to wall construction, but the inventor, C. W. Fellgren, has developed the system for use in constructing floors and roofs.

Ingersoll System:

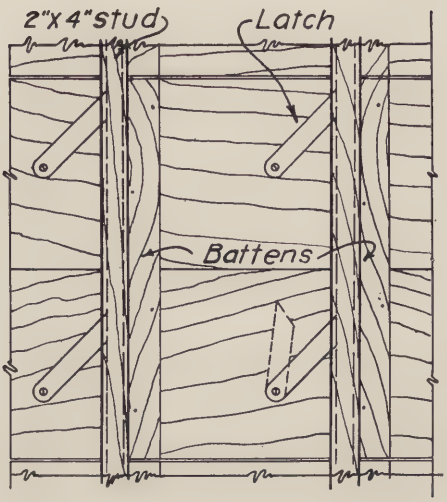
This method is more particularly adapted to industrial houses where several units of similar design and plan are to be built. These might be called standardized houses. Footings and basement floor are placed in one operation, after which form work for the entire house is erected at one time and the house is completely cast during one operation.

An interior rigid framework for the two stories is first erected. This framework consists of columns continuous throughout all stories and held in their positions rigidly by trusses. On this supporting framework are hung the forms which mold the concrete of the outside and partition walls, the stairs, floors and roof, the cornice, brackets and other ornamental work.

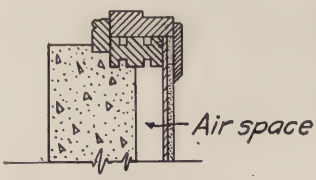
The forms are kept from bulging by means of iron bars which extend through forms and wall. Wooden separators are placed between the



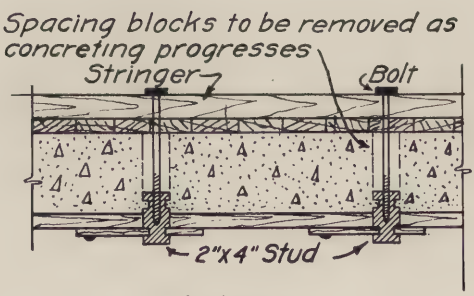
PLAN SHOWING DETAIL OF WINDOW FRAME



ELEVATION OF INSIDE FORM SECTION

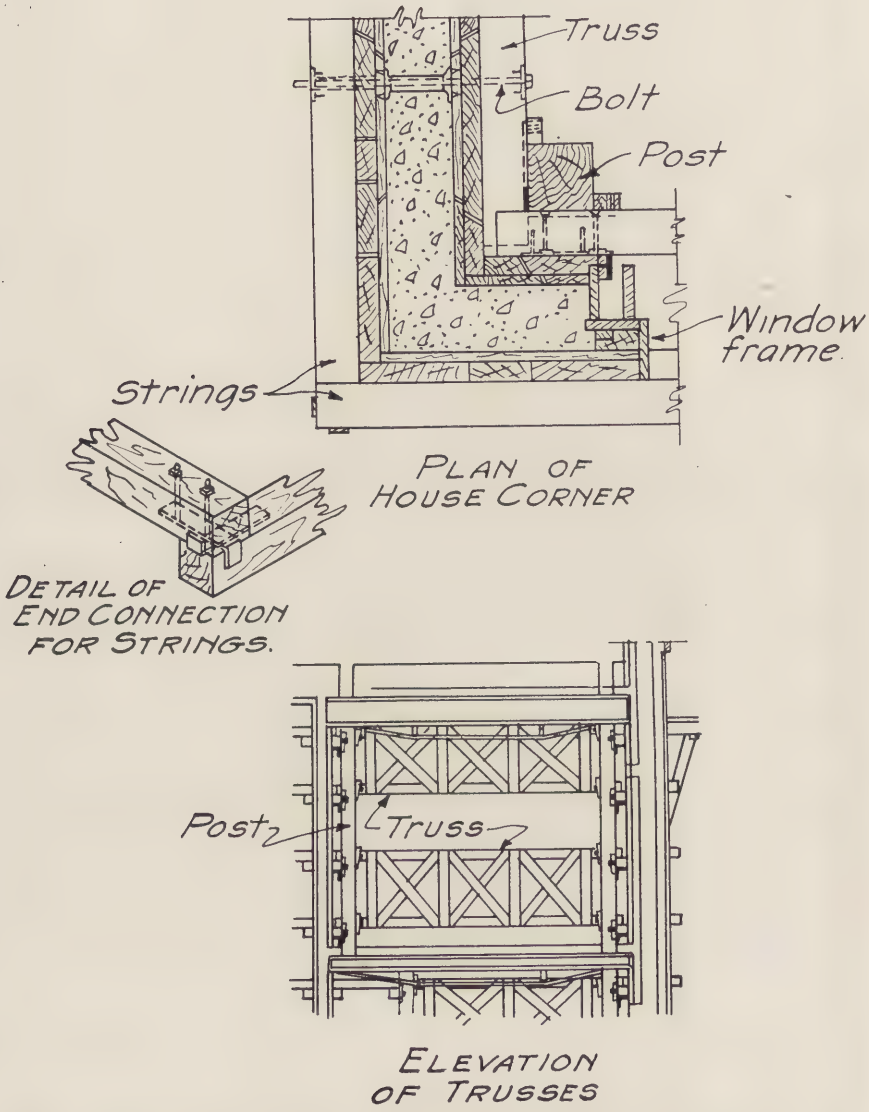


PLAN SHOWING DETAIL OF DOOR FRAME



PLAN OF WALL AND FORM

Feilgren System. General details of forms. The door and window frames are imbedded in the concrete, effectually preventing the passage of air behind the frames.



Ingersoll System. Details of form at window openings and method of supporting floor and wall forms.

inside faces of the forms, so that the entire form structure is absolutely rigid before any concrete is placed.

All reinforcing steel is placed in the form before the house is cast. The vent and soil pipes, electric conduits, metal flue lining for the chimneys, window frames, door bucks, furring strips, nailing blocks, etc., are also set in place before the concrete is cast.

The concrete is placed through window or door openings on the lower story, thus eliminating the danger of separation of the aggregate from the cement, which might occur if the concrete for the entire house were placed from the roof.

Metaforms System:

The Metaforms system of forms is based on a 24-inch square, light metal unit. Special units of dimensions graded down every two inches to a 2-inch plate permit the construction of walls of any multiple of 2 inches in length, and one special 3-inch plate used in conjunction with these enables a wall to be built any odd number of inches in length.

The unit consists of a galvanized iron sheet with a 1-inch by 1-inch angle riveted to all sides, and an additional angle across the middle of the plate to act as a stiffener. The top and bottom angles are provided with holes opposite each other, in which spikes are dropped to maintain vertical alignment. On each of the side angles there are small pins projecting one-eighth inch, near the top and bottom, which fit into corresponding holes in the angle of the adjoining unit, thus maintaining horizontal alignment. One of the side angles has pinned to it two malleable iron clamps which clamp the flanges of adjoining units securely together. These units are wired in a manner similar to wood forms, holes being provided in the plates for that purpose. Stay rods, adjustable to the thickness of the wall, hold the plates apart.

A one-inch angle with clamps is provided for outside corners of the wall. The inside corner connection is a 2-inch angle having smaller angles riveted to the extremities of the legs. A hinged corner with clamps can be used for non-rectangular buildings or bay windows.

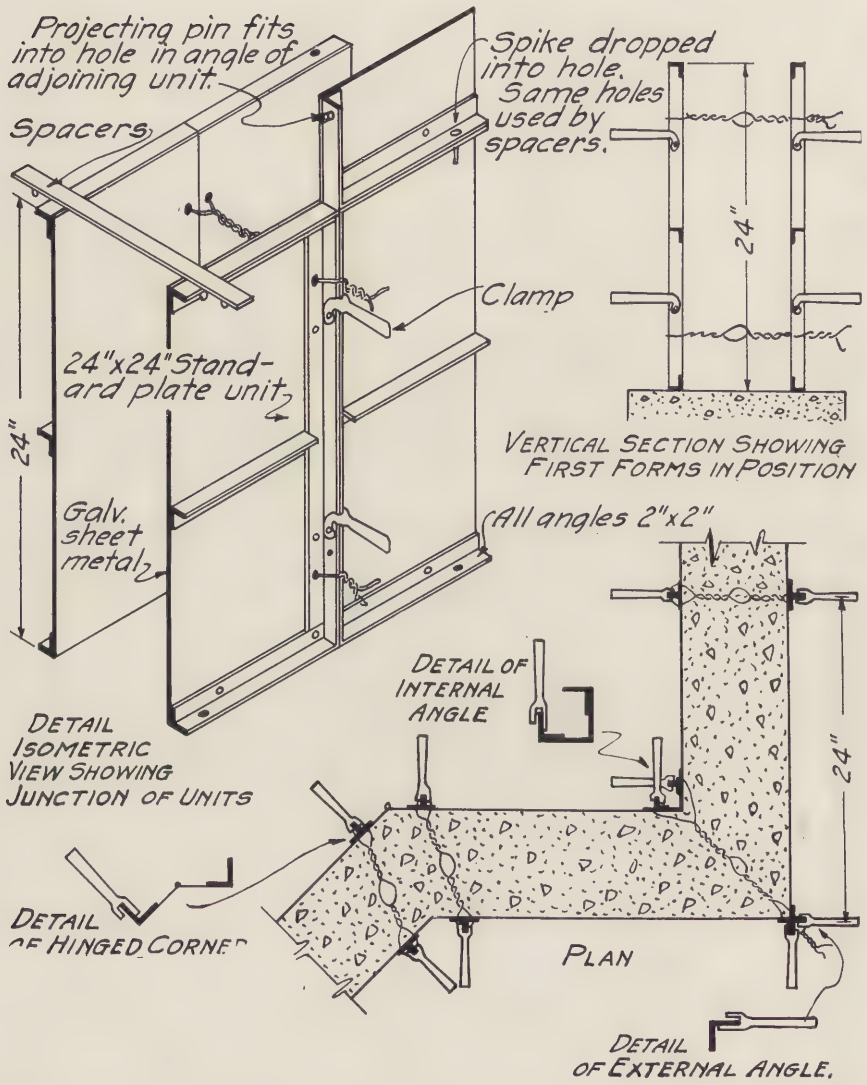
Morrill System:

The standard Morrill form unit is a plate 24 inches square, weighing about 30 pounds. Another size is an oblong plate 16 inches by 48 inches. Plates are punched from the sheet and flanged by pressing in a die. The plates are secured together, flange to flange, with "U"-clips and steel wedges.

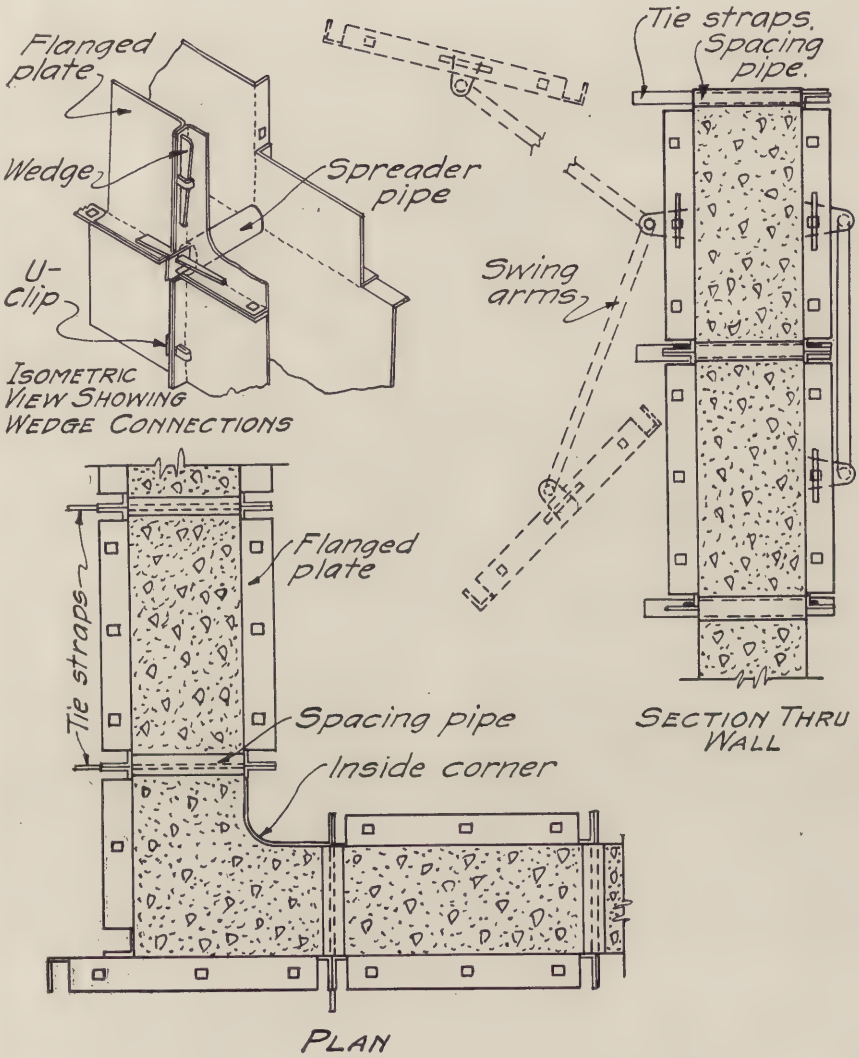
Spacers and wedges secure the two faces of the forms rigidly in place. To avoid the use of special dimension plates to fit different size buildings, the corner plates lap by, thus obtaining any dimensions desired.

The molds may be used in four different ways, according to the work to be done:

1. The plates may be set up story high and the entire story cast at one operation.



Metaforms System. General details of forms. The clamping devices are fastened to the forms thus reducing the number of loose parts.



Morrill System. Details showing application of forms. The speedy movement of forms afforded by this method provides an economical construction.

2. The two-tier "Swing-up" method may be employed.

3. The one-tier "move-forward" method may be used.

4. For the small job, the two-mold "swing-forward" outfit is most suitable.

The first method allows the casting of an entire story of a house in one day, using the forms three times on a two-story house. The second utilizes a smaller equipment, and the walls for the average two-story cottage take one week, using the forms nine times to construct courses 16 inches high. The third—the one-tier "move-forward" outfit—requires only a few pairs of plates, and it is possible on a development to have from 10 to 20 houses going on at the same time.

In the two-tier "swing-up" method, the upper and lower tiers of plates, both inside and out, are secured together in multiples of 10 to 15. These two tiers of plates are connected from their center points by hinge arms. The two tiers of plates are set up on the foundation and filled with concrete and allowed to set a few hours. The lower tier is released by driving out locking wedges. This allows the plates to hang free and to swing up, revolving through a half circle on the hinge arms connecting the centers of the pairs of plates.

In this way from 40 to 60 square feet of wall form is set in one operation, and the plates are swung up, tier after tier until the top of the wall is reached. Then the connecting wedges are driven out and the plates are ready to move to the next job.

By the "swing-up" method, three men can raise and set in place 50 square feet of form in less than three minutes.

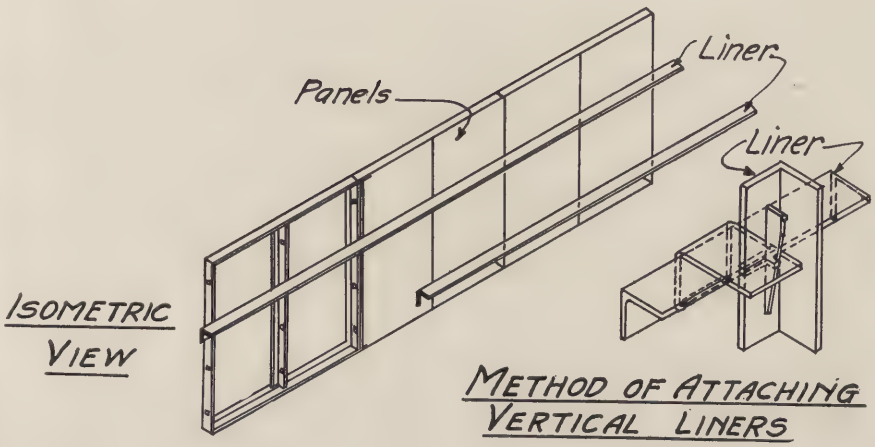
In using the one-tier "move-forward" method, a few pairs of flanged plates are set up where the wall is to be molded. When the molds have been filled with a "quaky" mix, the first molds filled can be removed and passed forward to a new position along the wall.

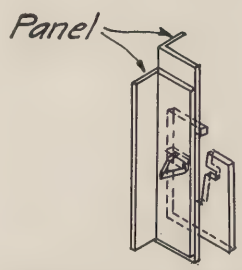
The two-mold "swing-forward" method employs the smallest of the Morrill Wall Molding outfits. By this method, the wall is molded in place block by block. The concrete must be stiff enough to stand alone so that the side plates may be stripped at once or some delay must be allowed for the concrete to harden sufficiently to stand. With this outfit corner angle rods are used to keep the wall straight and plumb. The outfit can be carried on a wheelbarrow.

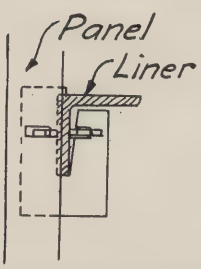
Blaw-Knox Forms:

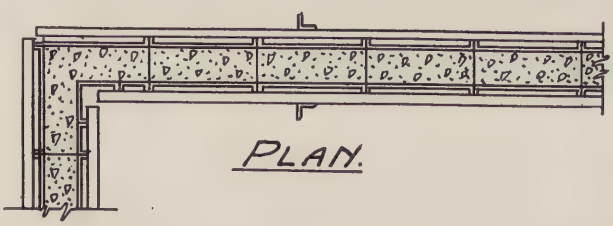
Blaw-Knox forms consist of standard sheet metal panels two feet square reinforced with steel angles on all four sides and diagonally. Fractional panels, lap and corner panels are used for adjusting the forms to various wall dimensions and thicknesses.

In assembling, the forms are secured to each other by means of wedge keys that are interchangeable and are slotted. The wedges are inserted in holes in the form flanges and a second wedge is driven into the slot of the first wedge, locking the forms securely. When forms are to be shifted by hand they are usually assembled in single courses two feet high (the height of panels) in units containing not more than









Blaw-Knox System. Details of forms and method of assembling panels.

twenty-four square feet of surface. The forms are then fastened to horizontal liners ordinarily 11 feet 6 inches long.

The horizontal liner is attached to the forms by means of small plates slotted to take the leg of angle liner. These plates have an integral latch piece which is inserted in corresponding flange slots in the form panels. When horizontal angle liner is placed in the slot in the plates, the latch piece is drawn up tigthly and liner is made secure with wedge key. The forms are now securely fastened and aligned.

Two to five courses of assembled sets can be used by spacing one above the other and these are joined by means of vertical liners placed six to eight feet centers, which are fastened to the horizontal liners by means of plates similar in principle to those described.

Where a large amount of concrete is to be placed at one time wire ties are used to prevent spreading. When using single tier forms, clamps are used at top of forms to prevent spreading of forms.

Specially designed sheet metal forms are best adapted to floor and roof construction.

REPORT OF COMMITTEE ON UNIT CONSTRUCTED HOUSES

Until very recently house construction has been almost wholly an individual enterprise. Modern methods of industrial organization and labor-saving machinery have lately been applied on every hand, resulting in enormous increase in production during the last century and making possible the great forward strides in the world's accumulation and enjoyment of wealth.

During the past ten or fifteen years some attention has been given to the feasibility of applying quantity production to house construction, so that dwellings, like other products, might be "machine-made" instead of "hand-made." Experiments were made with varying degrees of success; but the problem was not faced in a really big way until war-time expansion of industry and restrictions on building activities created an acute shortage of houses in all industrial communities throughout the country. The war also demonstrated that the employer of labor must often provide comfortable homes for his employes and that proper housing is just as important as any part of plant or equipment.

It was evident to every thinking man that the prevailing methods of house construction could not relieve the situation. Material and labor prices had increased to the point where individual effort was discouraged by the prohibitive cost. To make matters worse, so-called skilled labor became less efficient as wages increased. As one example of many, bricklayers who formerly laid an average of 2,200 bricks per day at 55 cents per hour, now lay only 1,000 bricks, or less, per day at $1 per hour. Another typical case came to light in January, 1920, when an old established piano manufacturing company in England closed its doors and went out of business. The officials of the piano company issued a statement to the effect that for each piano turned out per week they were employing 26 men, as against 12 men in 1918 and 6 before the war, and that the factory wages on each piano exceeded the selling price.

In the face of such conditions it is not surprising that Architects, Engineers and Builders are turning to a method of house construction which makes use of modern labor-saving machinery, employs the advantages of standardization and scientific management, utilizes materials locally available, and at the same time produces houses of permanent and fire-resistive construction and correct architectural design.

Unit Construction

"Special unit construction" is the term applied to that method of concrete house construction in which wall and floor slabs, beams, girders, partitions and columns are precast at some convenient central point, conveyed to the building site and assembled into the finished structure.

The units must be kept in the curing yard from 10 to 30 days, depending on the weather and the size, thickness and shape of the sections. At the time of casting all surfaces which will be exposed to view in the completed structure are finished with a wood float, with pebble

Residence at Dallas, Texas, built of small concrete units with stucco finish according to the Sawyer System.

An interesting example of the Moore System type of concrete house at Houston, Texas.

dash, exposed aggregate or any other finish desired. Any surface which is to be stuccoed should be scored to provide a suitable ground for the stucco.

In many cases it is a distinct advantage to use crushed blast furnace slag as the aggregate for the concrete, in order to reduce the weight and the cost of handling the sections.

Fire resistive construction requires that all structural parts be permanent and fire-resistive. The non-structural parts, such as interior trim, may be of combustible material, but it is best to reduce combustible trim to the minimum by omitting it around windows and doors, rounding off plastered corners and putting in concrete base boards and mastic floors.

In several types of special unit construction the structural framework is cast in place, the remainder of the building being composed of precast units of somewhat smaller sections than in types where all parts are precast. This is in reality a combination of monolithic and unit construction. In all cases, however, the precast units can be made to best advantage at a central plant with suitable mechanical equipment.

Special unit construction where all parts are precast is best adapted to the erection of large groups of houses. This means that the most profitable field for this type of construction lies in industrial housing developments. This in turn involves town planning, colony design and architecture, provision for recreation and the construction of streets and sewer systems. Town planning, architecture and engineering must be combined and harmonized to procure satisfactory results.

In many cases houses are owned and controlled by the industry for a number of years and consequently the upkeep and insurance are important items in considering cost.

Requirements of Architectural Design

One of the greatest difficulties encountered in quantity production of houses is the selection of a type of architecture which will utilize available ground, be attractive and still be susceptible of some standardization. Town planners too often consider the town plan as a problem in map making without regard to the requirements of architecture or construction.

In selecting a type of architecture for any case in hand, it cannot be too strongly emphasized that unit construction does not contemplate standardization of living conditions of human beings through the construction of mile upon mile of houses of identical appearance. Individual cases must be studied and architectural types and construction methods selected which will produce a sound developement both from the aesthetic and financial standpoints.

The type of building may be selected with the knowledge that unit construction is suitable for any form of architecture which permits a reasonable duplication of standard structural members, whether in single houses, semidetached houses, group houses or apartments.

On a development where skilled labor is to be housed, or where it is advantageous to dispose of the property through sale, the detached or semidetached house should be adopted.

If the development is for unskilled negro or foreign labor, where the property will be operated on a rental basis, the group, or terrace type of houses should be selected.

In congested industrial districts, where the great demand is for two, three or four rooms with bath, the most suitable type is the apartment structure, having a maximum amount of light and air and requiring a minimum of household work.

Plans and Details

Plans for the houses must show proper regard for the type of construction and the character of future occupancy. Main partitions on the upper floors must be placed directly over those on floors beneath. Every foot of space must be put to some useful purpose. Houses intended as living quarters for negro and foreign families, must devote a comparatively large proportion of space to sleeping quarters, because of the large families usually found in these cases. Thus the kitchen and dining room may be one, while the living room may also be a bedroom. On the other hand, families of the better class of skilled workmen are smaller on the average, so that more space may be assigned to living than to sleeping quarters. Even the families of skilled workmen will not object if the outer door opens directly from the porch to the living room, without an intervening vestibule; and the bathroom need be no larger than absolutely necessary to provide space for the fixtures. Linen closets, built-in book cases and cabinets, window seats and other conveniences of this kind must be entirely eliminated, for they add to the difficulties of construction, take up space, and cost money.

Unit construction simplifies the problem of securing hollow walls, a matter of great importance in preventing dampness, conserving heat in winter and keeping the building cool in summer. Slabs may be set up in the form of double walls with an air space between, and in extremely cold climates a triple wall with a double air space can be used to good advantage. Triple walls were used in a group of eight houses erected in 1914 at St. Johns, Quebec, after the Simpsoncraft system.

Because of the fact that walls, partitions and floors are built of incombustible material, metal conduits for electric wiring may be omitted. Wires can be passed through porcelain tubes which are placed in the concrete when the sections are poured in the casting yard.

Typical Examples

Special types can be illustrated most effectively by direct reference to actual projects carried out by unit methods.

Youngstown Sheet & Tube Co. Project

This project consists of 281 houses of the group, or terrace, type of arrangement, of which 146 houses, consisting of three and four rooms with bath and laundry, are located in the foreign colony, and 135 houses, of two, three and four rooms with bath and laundry, are in the negro colony.

Living rooms and dining kitchens have average dimensions of

16 by 10 feet, bedrooms are 16 by 10 feet and 10 by 10 feet, and laundries are 15 by 10 feet.

These houses constructed in 1918 by the Unit Construction Co. of St. Louis, consist entirely of reinforced concrete members for the walls, floors, partitions and second story ceiling. The roof above the second story ceiling is framed in timber and covered with tile. This extensive use of reinforced concrete members eliminated about 75 per cent of the carpenter labor and 80 per cent of the plastering required under ordinary methods of construction. Revised designs and engineering plans contemplate the use of steel sash, mastic floors, complete elimination of wood trim, the adoption of concrete baseboards and concrete roof construction, thereby dispensing with practically all carpenter labor on future operations.

Outer walls are cast with concrete studs and have a wooden furring strip attached, and are lathed and plastered. This produces a dead air space. Floors are provided with nailing strips embedded in the concrete and have wood flooring laid directly on the concrete slab.

All of these houses are provided with modern plumbing, electric lights, and gas connections in the kitchen and the laundry. Interior walls, partitions and ceilings are painted in oil, while the exterior concrete is treated with a waterproof paint.

The entire project is operated on a rental basis by the Buckeye Land Company, a subsidiary of the Youngstown Sheet & Tube Company.

The process of manufacture of the units followed the general lines of modern industrial operations. They were cast in a casting yard, consisting of a series of concrete casting platforms about 20 feet wide and several hundred feet long, the space between the platforms being occupied by a standard gage track over which a locomotive crane was operated.

The mixing plant at one end of the yard consists of a storage house for cement and bins for sand, crushed stone, gravel or crushed slag. All these materials are controlled by machinery, such as belt conveyors, bucket elevators and derricks with clam-shell buckets.

Concrete was deposited directly into the forms by special hopper cars and locomotive cranes. After deposited it was struck off and finished where a smooth surface was desired, or scored to produce a rough surface to receive interior plaster or exterior stucco. Many of these wall sections were as large as 10 by 20 feet, while some floor sections were 15 by 20 feet. After the concrete had hardened, sections were lifted out of the forms by the locomotive crane and placed in stock piles ready for erection.

Manufacture of the units proceeded while the general development work, such as construction of streets, sidewalks and sewers, excavation and foundation work, were being carried on. Erection of the houses proceeded independently of manufacturing or delays in the receipt of materials. The units were conveyed from the stockyard to the building site by truck and put directly into place by traveling erecting derricks.

Labor requirements were easily met. Carpenter labor was only 25

Unit built concrete houses at Youngstown, Ohio. This entire group consists of 281 houses and represents an important example of Industrial Housing.

A group of Simpson Craft concrete houses at Lansford, Pa., built for the Lehigh Coal and Navigation Co.

per cent of the requirements on ordinary construction. Erection was handled by steel erectors, of whom the majority have been in the company's employ from five to ten years, are thoroughly familiar with the work and produce a real day's work.

Aside from the above mentioned classes of labor and such specialists as hoisting enginemen, crane operators, and men skilled in the use of mixers and the distribution of concrete, the balance of the labor was so-called unskilled workmen.

The construction company maintained an erection speed of three houses every two days for each erection crew. The entire project of 281 houses, including streets, sewers and all utilities, was completed in less than one year with an average crew of less than 200 men, working with modern machinery.

In this type of work the number of houses to be erected within a given time resolves itself into an engineering schedule, and from the experience gained at Youngstown the construction company feels confident that the work may be so organized that a housing development of 500 or 1,000 houses can be scheduled and handled with greater efficiency than a smaller project.

COST.

The following is a statement of the cost of the Youngstown project, including the construction company's fees on houses, streets, sewers, water, gas lines and general development:

	Houses	Streets, Sewers, Water & Gas lines & general development	Total
146 houses in foreign colony	$513,848.72	$167,060.53	$680,909.25
135 houses in negro colony	315,899.71	133,284.00	449,183.71
	$829,748.43	$300,344.53	$1,130,092.96
		Foreign Colony	Negro Colony
Average cost of houses alone		$3,519.51	$2,340.00
Proportional cost per house, of streets, sewers, water & gas lines and general development		1,144.25	987.29
Total average cost of houses, including improvements		$4,663.76	$3,327.29

SIMPSON CRAFT CONSTRUCTION

The inventor of this system, John T. Simpson of Newark, New Jersey, makes the following statement as to the objects sought:

"To meet the many objections to the older and less desirable types of construction and at the same time produce a building constructed entirely of fire resisting materials; one that would be economical in maintenance as well as in first cost, and from which the question of insurance could be eliminated; a building with dry warm walls and floors; one that may be built of standardized sections of precast concrete, adaptable to many styles of pleasing architecture, without increasing the cost."

A representative example of the Simpson Craft type of concrete houses. One of a group at Lansford, Pa.

Concrete bungalow with stucco finish at Los Angeles, Calif., built after the Harp System

ARCHITECTURE.

The Simpson Craft System is so designed that any one of several styles of architecture may be selected, the sections being standard and interchangeable from one house to another and from one style of architecture to another. The sections may readily be increased or decreased in size and shape to conform with conditions of loading or span and all sections may be calculated by the usual formulas for concrete design.

While certain standards have been adopted such as 2 feet 8 inches for the width of the doors and windows and wall studs spaced 3 feet 4 inches on centers, this spacing may be varied at will, though standard spacing will prove a little lower in cost.

DETAILS.

The details of window frames, whether of steel or wood, are simple and the attachment of all trim is secure. Stairs, stair railings, chimneys, porch columns, railings, porch roofs, brackets, flower boxes and other miscellaneous details may be made of concrete and if desired, the interior of the house may be treated in the ordinary manner.

ROOFS, WALLS, PARTITIONS AND FLOORS.

The roof may be built of either precast concrete or wood timber and covered with any type of roofing desired. Where precast concrete is used provision is made for securing the roof covering.

The walls, partitions and floors being hollow, placing of plumbing and wiring is just as easy as in buildings of wood construction.

It has been found in practice that it is an easy matter to cut holes through the beams and floor slabs for running of wires or pipes or for fittings to attach them.

MATERIALS AND MANUFACTURE.

Any approved aggregate may be used for the concrete which is usually made of 1:2:4 mixture for the heavier sections and 1:1½:3 for the lighter sections. The reinforcement may be of any standard type of expanded metal, woven wire and plain or deformed bars.

Wooden or steel moulds may be used, wood being cheaper for small operations, though steel is better for quantity operations. Wooden moulds and field forms average about $50 per house for a group of ten houses based on average speed of manufacture and erection.

At the time of casting, the finish of the wall and floor slabs is determined and the surfaces finished accordingly. For wall work the finished face of the slabs may be made on the bench, with wood float, pebble dash, exposed aggregate, or any other finish desired. The surface may also be roughened or scratched, to form a key for a coat of stucco to be applied after the slabs are in place.

Floor slabs may or may not be used when a wooden finished floor is desired. In the cheaper grade of houses a ceiling slab only is used, but in the better grade houses or where a cement or plastic finish flooring is used, a floor slab is desirable. With cement finish floors, the slabs

are roughened or scratched on the top surface during casting. For wood finished floors on top of slabs, the slabs are grooved for the wooden sleepers and wires built into the grooves which are later used to secure the sleepers in the grooves.

In the earlier examples of Simpson craft houses the inside as well as outside surface of all walls and partitions was formed of precast slabs. The walls of some of these houses, notably those at St. Johns, Quebec, Canada, had a third slab in the center of the outside walls providing two air spaces.

The slabs are set up between concrete channel-shaped field forms and after placing the floor beams or rafters supported by them, the studs are field cast, binding the structure together. The ceiling slabs are then placed on the lower flange of the beams, and the cross bars of the panelling cast. The floor slabs are then placed on top of the floor beams.

Erection

The sections have been standardized so that with the exception of the beams and rafters they can be handled by two men. They may be made in a shop or casting shed located at any convenient point, either at the source of supply of the raw materials or near the site of the buildings or at an established yard for the sale of building materials.

As soon as the sections come from the moulds,—usually twenty-four to forty-eight hours after casting—they are stacked in the yard for curing where they remain for ten to thirty days, according to the size and shape of the sections. About 90 per cent of the parts of the building are precast light sections which are later set up on the foundations and held in place by about 10 per cent of field-cast sections.

It has been demonstrated that a six-room house 24 feet wide by 28 feet deep, two stories high, can be fully erected from top of foundation walls to the underside of the roof by four carpenters and four laborers in five days, which includes the setting up of all shop-cast pieces, securing them in place by the field forms and pouring of all field-cast sections.

The removal of the forms and the touching up of the surface is not included in this time. This work would require two days for two laborers and three days for one cement finisher and one helper.

As a convenient means of designating the four different systems of Simpson Craft Construction, they are called Systems A, B, C and D.

System "A" is a double or triple wall construction, with precast slabs set between the field forms previously described, air spaces being thus provided. This system requires no plastering, since the interior surfaces of all walls, partitions and ceilings are finished in advance at the time the parts are cast. This system was used on the earlier work at Durham, N. J., and St. Johns, Quebec, in 1913 and 1914, respectively.

In System "B" the outside walls are made of 1-inch precast slabs set up between field forms, as in System "A," but with the slabs omitted from the partitions, ceilings and inside face of exterior walls. Instead, galvanized wire loops, or "hair pins," are embedded in the concrete

studs and beams of the field-cast framework. Heavy waterproof building paper is then placed against the inside face of the wall studs, against both sides of partition studs and against the under side of ceiling beams. The paper is well lapped and is forced over the "hair pins." Metal lath with $\frac{3}{8}$-inch ribs is then placed against the building paper and is secured in place when the ends of the "hair pins" are bent over. All nailing strips and grounds for securing trim are placed behind the metal lath and fastened to it with staples. After cement plaster is applied to the metal lath the resulting construction consists of hollow walls, partitions and floors, with the air space and waterproof paper acting as insulation in exterior walls and as sound deadeners in floors and partitions.

In both Systems "A" and "B" the stairs, railings, porches, columns and chimneys are of precast reinforced concrete units. System "B" was used in 21 houses erected during the winter of 1917-1918 at Lansford, Pa., Manheim, West Va., and Cementon, N. Y.

In System "C" the precast wall and floor slabs of the two previous systems are omitted. Precast reinforced concrete studs, beams and rafters are set in place on the foundations and are bound together by a field-cast girt or plate resting on top of the studs and made the same depth as the floor and roof beams. For long spans intermediate field-cast columns and girts are erected. In order to brace the structure thoroughly the corner studs or posts are field-cast and strengthened with knee-braces.

After the skeleton frame of field-cast and precast members has been erected, the ceilings, partitions and both sides of exterior walls are covered with waterproof building paper, metal lath and plaster, precisely as the ceilings, partitions and the inside face of exterior walls are built under System "B." Floors and roofs are formed by placing ribbed metal lath or similar material on top of the reinforced concrete beams and rafters, then placing the required wooden sleepers and nailing strips, after which a light slab of concrete is poured.

Under System "C" a somewhat greater variety of construction is possible than under System "A" or "B." This variety may be secured through variation in the size and spacing of door and window openings, through the construction of dormers and gables, and in other ways, because of the greater flexibility of the system.

System "D" is now being used in France and Belgium in the reconstruction of some of the war-devasted areas. In some respects System "D" is similar to System "C," in that the wall studs are precast members, but with the difference that in System "D" the exterior wall surface may be of any of the following material:

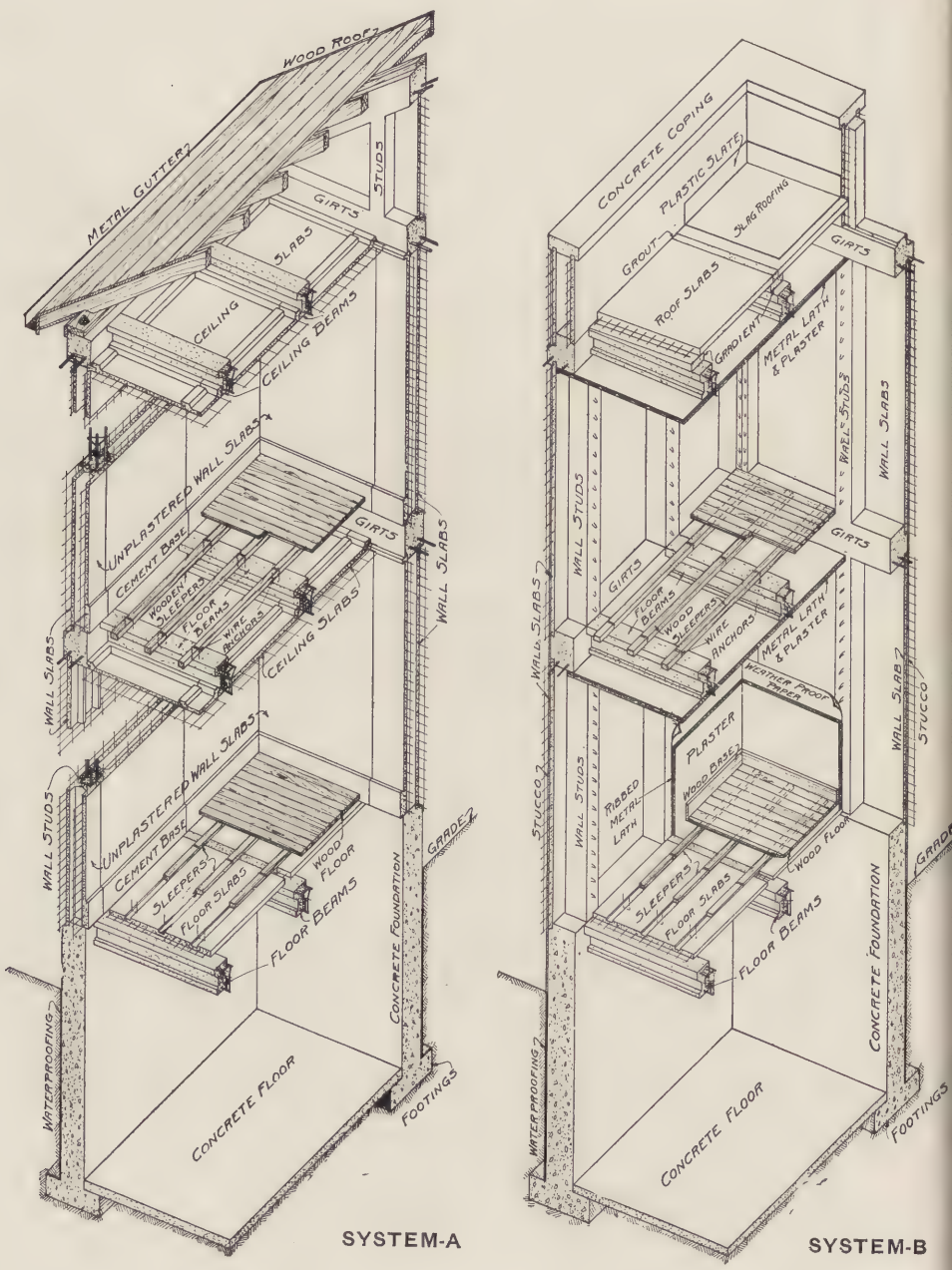
(a) Precast concrete slabs on which the desired finish has been made on the bench and which may be set up in courses similar to stone ashlar.

(b) Thin limestone ashlar.

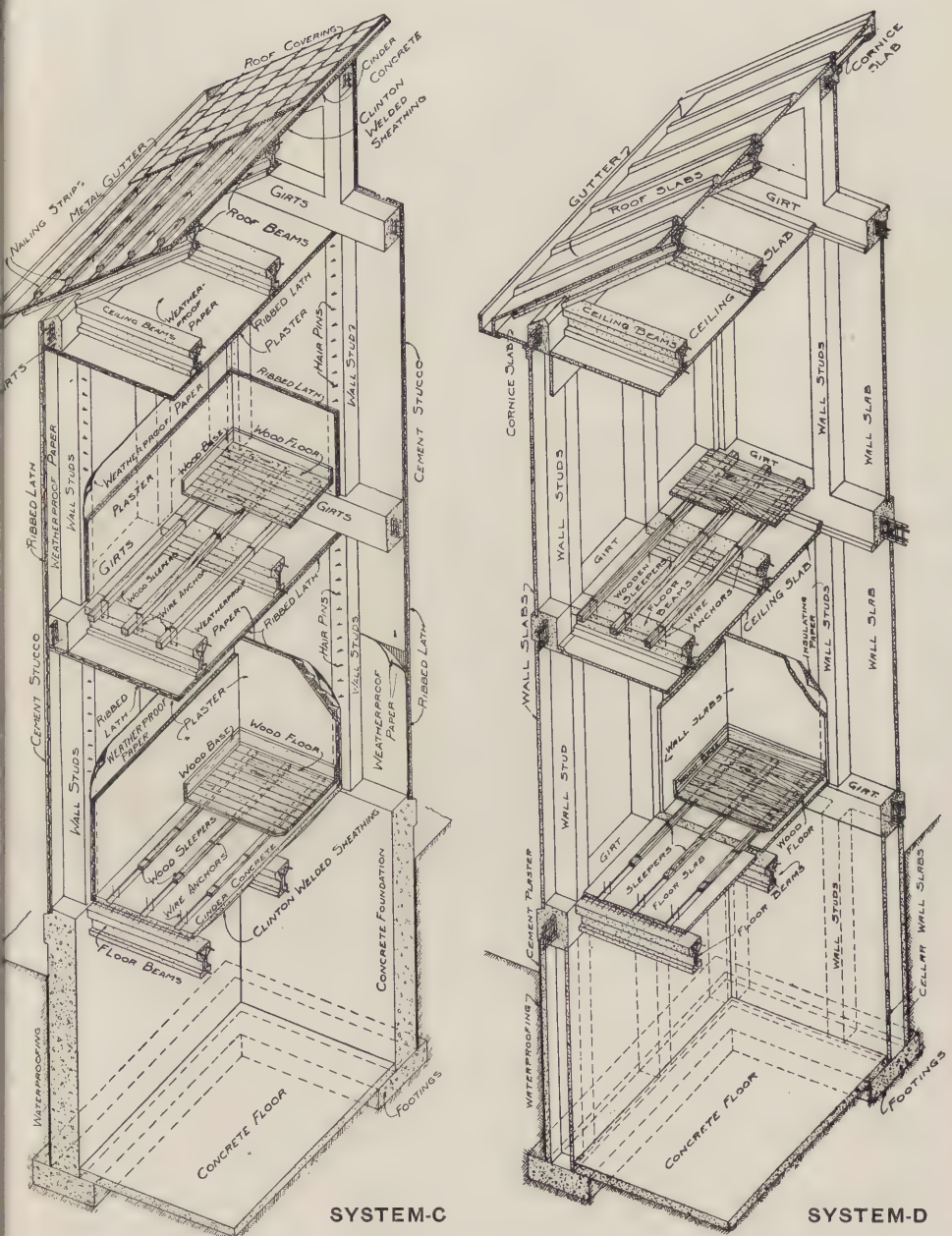
(c) Thin architectural terra cotta slabs.

(d) Tile-faced precast concrete slabs.

(e) Rough concrete slabs, plastered with white portland cement stucco.



Simpson Craft Concrete Construction, Systems A and B.



Simpson Craft Concrete Construction, Systems C and D.

Interior view of a Simpson Craft house under construction at Lansford, Pa.

(f) A thin precast concrete slab to which nailing strips are attached similar to floor sleepers and to which wooden shingles and clapboards may be nailed.

In the lower priced houses built after System "D," the floor beams and rafters are spaced 40 inches apart and the floor and roof slabs are omitted. Ceiling slabs are provided either flush with the bottom of floor beams if a plain ceiling is desired, or raised up between beams if a beamed ceiling is preferred. Nailing blocks are placed in the floor beams if they are to be encased in wood. For the partitions and the inside face of exterior walls special slabs of cinder concrete or gypsum are cast on sheets of waterproof building paper and set up with the paper side against the studs.

In the French and Belgian work the finished roof is formed of precast reinforced concrete slabs 40 inches wide and varying from 6 to 8 feet long, usually colored red. These slabs, or large tiles, are self-locking and are secured by grout to the concrete rafters. The ridge has a separate capping piece, while the gutters are cast as an integral part of the lower course of slabs.

The usual wooden window and door frames are omitted from the French work, because of the aversion to wood construction in France. Door and window hinges are embedded in the concrete when the slabs are cast. Winding stairs, ornamental chimney tops, window balconies and other decorative features are all made of precast concrete and set in place.

The first of the French buildings are under construction at Soissons. These are four-family structures, each family being provided with a general living room, two bedrooms, two clothes closets, a kitchenette, a food closet, a coat closet and a toilet. Two families are quartered on each floor. Those on the upper floor have separate stairways and all have separate entrances, for the common entrance of the American apartment building is not popular with the French housewife. Seven-story apartments of four, five and six rooms each, have been designed after this system for construction at Soissons.

In all of the foregoing systems, designated as Systems A, B, C and D, it is possible to manufacture the precast sections in a centrally located shop during the winter, from where they may be distributed later as needed. It is entirely feasible to standardize many parts and carry them in stock, in the same manner as lumber and other building materials.

Under ordinary conditions it is possible for a moderate-sized force of men to set up the entire frame of a Simpson Craft house, including the roof, in from four to six days after the foundation is ready. The roughing for the plumbing, heating and lighting systems may be put in immediately after the frame is up, while the walls and ceilings can be lathed and plastered without waiting for the removal of forms.

All the Simpson Craft houses constructed to date have been built by contractors who had no special training in concrete work.

The first house erected, that at New Durham, N. J., in 1913, cost $4,000, including brick fireplace, steam heating system, white enameled plumbing, electric lighting in metal conduits, slate roof and copper gutters and flashing.

The ten houses at Lansford, Pa., built in the winter of 1917-1918, were taken on a lump sum contract at $3,000 each, this price including steam heating, electric lighting, white enameled plumbing, asphalt shingle roof, wood finished floors on the first floor and cement finish on the second floor.

COMMITTEE ON UNIT CONSTRUCTED HOUSES

W. W. Boyd, Jr, *Chairman*, St. Louis
A. C. Irwin, *Secretary*, Chicago
S. B. Moore, Houston, Tex.
E. J. Russell, St. Louis
John T. Simpson, Newark, N. J.
K. H. Talbot, Milwaukee

INSULATION OF CONCRETE WALLS

NOLAN D. MITCHELL
Structural Engineer, Supervising Architect's Office
U. S. Treasury Department, Washington, D. C.

Since the dawn of civilization man has made houses to protect family and chattels from the weather and depreciation. With succeeding generations better and better protection has been afforded.

In view of the many improvements that are being made in all our arts we can readily imagine great forward strides in house building in the near future. Certainly some forward movement is needed when the loss by fire is now approximately $300,000,000 in money and hundreds of lives each year. And to this must be added the upkeep cost of our large standing army of insurance and fire protection forces. The fire-fighter comes after the fire starts to limit it to as small space as possible and the insurance man comes later to distribute a part of the money loss to the more fortunate, taking no inconsiderable amount in fees for his services.

Another phase of the situation is the growing scarcity of fuels. We have been, and are still, very prodigal of them. Now is the time to consider in an economic way what we can do to conserve our supply. If we can make houses that do not require so much fuel for heating we should at least investigate their possibilities.

One cannot deny that our better constructed wooden houses have been comfortable and, except against fire, have afforded reasonable protection at a low first cost. While our lumber resources are by no means exhausted, it is becoming more and more uneconomical to build wooden houses. In making the change from the wooden house to types of more permanent construction we must select some kind that will provide as much or more comfort for the occupants. Americans will accept no less.

The unfortunate thing that we realize at once is that our common fire resisting materials of construction have a high rate of heat conductivity as compared to the more combustible kinds. The cold walls resulting from the use of these has had no small influence in retarding the change from the wooden house.

The maintenance of an even temperature in a house resolves itself into provision of adequate heating apparatus and a construction that will satisfactorily prevent rapid dissipation of heat through floors, walls and ceilings. It is just another phase of the problem that refrigerating engineers have found to be of such importance in their work, namely, insulation.

There is plenty of evidence that many builders realize the necessity of insulation against heat transference, but we are not so sure that an altogether satisfactory solution has been found.

Let us look briefly into what has been done and the results. Wood furring with lath and plaster on the inside was probably the first effort to avoid penetration of dampness and the condensation of moisture on

the inside of the wall. The result as far as insulating against the heat loss through an eight inch wall was an improvement of approximately 15%. Where the wall block absorbed dampness from the weather the result was not so good for in general any porous material in moist or damp condition transmits heat much more readily.

The hollow block was another development in the right direction. The total result was probably not so very different from the wood furring except that it provided no lodgement for vermin and no runway for fire. The chances for dampness showing on the plaster were much higher however, and there is no doubt that passage of dampness through the withes of hollow blocks is responsible for a large part of the long fight that advocates of concrete house construction have had to make to keep in the business.

Other builders realizing that dampness cannot travel by capillary action across a space bridged only by thin metal ties adopted that system and at the same time realized an improvement of about 20% over an 8-inch solid plastered wall. Hollow monolithic walls give about the same or perhaps a little better protection. The matter of detail of construction of the hollow wall is apparently more troublesome, yet with some builders they are still favorites.

A system, not so much in vogue, has been the building of solid walls of lean cinder concrete facing it with stucco on the exterior and plastering the inner face, or where the temperatures justify it, furring has been applied.

Another use of cinder concrete has been in making furring blocks to face the inside of the walls. I have not been able to find any data on the relative merit of these. One recent system embeds the porous block in the center of a monolithic wall so that the inner shell may serve as the supporting wall for floors and ceilings and thereby not break the continuity of the insulating course.

Other developments such as multiple cell blocks with offset withes, various forms of opening to allow freer circulation, etc., have been improvements in both insulating value and saving of materials.

A very popular building block is one made solid with projections on the rear face to bond with like projections on the blocks laid up to form the opposite face of the wall. This gives a good bond and is a simple arrangement easily cast allowing a wetter mix than that generally used in block construction.

All these efforts have made an appreciable improvement over the solid wall type, but generally the air spaces provided have been unnecessarily large and allow convection currents within the closed space.

A comparison of the results obtained by some of the above with the results of refrigeration insulating has led to investigation in a general way as to what might be done by using concrete as the structural member of the wall and combining with it an efficient insulating material.

As a basis a monolithic concrete wall 4 inches thick with 1 inch of corkboard insulation has been considered. It is not the intention to say that either the 4-inch concrete or the 1-inch corkboard is an ideal. In actual practice the thinnest concrete that will give adequate service

and any insulating materials of the requisite qualities for the work should be used. There are many insulating materials on the market and if a demand is created for still different ones we may be sure that some resourceful manufacturer will soon be able to meet it.

There is no perfect insulating material. Of the more common ones the heat transmission factor varies very closely in proportion to the density of the structure. The cellular ones such as wood, pith, cork, wool, etc., are best for house insulation. Any of these materials must be kept dry to give the best service.

The following table from "Mechanical Refrigeration" by Prof. Macintire of the University of Washington, gives the heat conductivity of some of our common building materials. The table indicates heat conductivity per square foot per inch thickness per degree difference in temperature per hour.

1″ Common brick	4.66
1″ Concrete (1:3:5)	4.29
1″ to 4″ Hollow tile	0.625
$\frac{7}{8}$″ Lumber (tongued and grooved)	0.83
Air space (from 1″ to 6″ thick)	1.66
1″ mineral wool	0.67
1″ builders paper	0.30
1″ pitch	0.79
1″ shavings (dry)	0.67
1″ granulated cork	0.48
1″ cork board (all cork, compressed)	0.26
1″ cork board (artificial binder)	0.28
1″ hair felt	0.31
1″ indurated fibre board	0.42
1″ compressed mineral wool board	0.33

For thicknesses of insulating materials up to 8 inches the conductivity is in almost inverse proportion to thickness. The effect of change of temperature on conductivity is very slight through the range of temperatures required in house heating.

As a comparison of the 4-inch insulated wall with the two usual types of furred concrete walls the following is submitted from Heat Transmission Tables compiled by Wm. R. Jones of the University of Pennsylvania. The heat transmission factors are:

(1) 8 inch solid concrete wall with 2″ terra cotta or wood furring and plaster ..... .53
(2) 8 inch hollow concrete wall (two 4″ thicknesses of concrete) center air space and furring as above ..... .38

From Peclets formula the transmission factor of—

(3) 4 inch concrete wall with 1 inch cork board..... .18

Assuming that we have a house 26 by 26 feet in plan, two stories high with 1,450 sq. ft. net wall area, an average difference in temperature of 35% for 20 hours per day would show the following amounts of coal burned to make up for heat losses:

(1) 53.65 pounds per day.
(2) 38.57 pounds per day.
(3) 18.27 pounds per day.

Thus it is seen that the thin insulated wall would show a saving over the other types of 35.38 and 20.30 pounds of coal per day respectively.

Assuming that the conditions as above continue for an average of 150 days each winter and that coal will cost $12 per long ton the savings capitalized at 6% for a 30 year period would justify expenditures of $400 and $228 respectively for the insulated wall over the other types. Or to come back to the square foot unit, 27½ cents and 15.7 cents respectively.

The saving of materials in the thin wall and the space saved by using them can be computed readily. If the same outside dimensions are maintained in the house the floor space for the thin wall type would be approximately 11% more than with the usual types.

The matter of increased comfort to tenant has not been given a money value, but it would be safe to assume that from a commercial standpoint, this would be far more than any of the preceding. Once a builder has established a reputation for making a safe, satisfactory, comfortable house, economical in maintenance, he can be assured that his services will be in constant demand and his profits can be larger as a consequence.

Considerable progress was made in Europe before the war in insulating dwelling houses and in this country a number of houses had been built using different types of the better insulating materials.

There are a number of insulating boards on the market now, several of which could be adapted to use in dwellings but for general excellence and suitability, when the cost of installation and insulating service rendered are considered the cork board will rank near if not at the top of the list.

The objection of expense may be raised at once but that cannot be so very much, if any, above our usual types of construction. Cork boards are selling at this time (February 19, 1920), for approximately 13½ cents per board foot in quantities. When it is considered that it replaces at once the inside furring at least half the cost of the material is offset. In the example given above the concrete saved would offset the other half of first cost.

Entrance to vestibule in private residence, Washington, D. C. An excellent example of the adaptability of exposed aggregate stucco and precast concrete of the same color and texture to exacting ornamental requirements.

NEW DEVELOPMENTS IN SURFACE-TREATED CONCRETE AND STUCCO

By J. C. Pearson, U. S. Bureau of Standards, Washington, D. C., and J. J. Earley, Sculptor, Washington, D. C.

The joint authorship of this paper requires a word of explanation. The writers have been closely associated by their membership on the Advisory Committee of the Bureau of Standards Stucco Investigation, and on the Committee on Treatment of Concrete Surfaces of this Institute. Both residing in Washington, they have had an unusual opportunity to study and discuss with each other the results obtained from the experimental work of the Bureau in concrete and stucco, as well as those from Mr. Earley's work in connection with his contracting business. These discussions often led to the consideration of possibilities somewhat beyond the range of established practice, in fact, beyond the limitations of established theories relating to the gradation and proportioning of the ingredients of mortar and concrete. It was therefore natural that ideas were conceived which were too visionary to be of use to any committee, but nevertheless deemed worthy of further investigation on the writer's own account. If these ideas proved to have no value, no one would be the loser; if they did amount to anything, the results would be a contribution to our knowledge of stucco and concrete. Hence it is a matter of some gratification to the authors to be able to describe these new developments in the treatment of concrete surfaces, the success of which is due largely to scientific studies of the behavior of combinations of various sized particles, and the development of a technique adequate for the molding of these combinations of particles in any desired form and place.

Studies of the experimental stucco panels at the Bureau of Standards led to the general conclusion that by adherence to well established practice, structurally sound and durable stucco could be secured, but that a great deal could be, or ought to be, done to improve its appearance. Crazing and map cracking are common to most stuccos, and are especially objectionable on surfaces of fine texture. The monotony of the cold grey cement color is objectionable, and is only partially relieved by the used of white cement and mortar colors. Finally the muddy appearance (due to cement, or cement and pigment, being too much in evidence) is objectionable from an artistic standpoint. Consideration of these matters suggested at once the use of less cement, and it became evident that by efforts in this direction improvement in appearance might be obtained. The apparently insurmountable obstacle to this departure from usual practice was, of course, the lack of plasticity in the leaner mixtures. Various methods of overcoming this difficulty were considered, and some experiments were made which indicated that a real improvement might be obtained by substituting fine inert material for a portion of the cement. The easiest way to accomplish this result seemed to be by using blended cements, that is, normal cements ground with a certain percentage of sand, stone-screenings, or other suitable materials. These experiments were never carried very far, however,

Vestibule, private residence, Washington, D. C. Console and cluster of fruit are of precast concrete; the remainder, including the mouldings, is of exposed aggregate, portland cement stucco.

for it did not seem possible that any method which might be devised for retaining plasticity could bring about the desired result, namely, the elimination of all the objectionable features mentioned above.

Serious as was this lack of plasticity in the lean stucco mixtures, it was after all, something that could be overcome by *work*. This was demonstrated by the fact that mixtures as lean as one part cement to six parts of stone screenings were applied on some of the Bureau of Standards panels, with excellent results. But the improvement in these panels as compared with some of the easier working combinations did not seem great enough to justify the increased cost of application. The question finally arose whether by careful attention to gradation of the aggregates this improvement in appearance might not be so enhanced that the cost would be a secondary consideration.

This idea came from the fact that Mr. Earley had succeeded in making complicated casts of concrete from specially graded aggregates in such manner that a very large percentage of the area of the treated surface (first wire brushed and then washed) was aggregate, and a very small percentage cement. Possibly due in part to the higher reflecting power of the surfaces of the exposed aggregates, the color of the concrete surfaces thus produced was determined almost wholly by the color of the aggregates, and only very slightly affected by the cement itself. A most convincing demonstration of this fact was obtained by construct-

ing two concrete slabs containing exactly the same proportions of specially graded aggregate, the one being mixed with grey cement, the other with white cement. After the surface treatment of brushing and washing had been applied, only an expert could have determined which slab contained the grey cement and which the white.

To digress still further for a moment, this method of obtaining permanent and very pleasing colors in concrete surfaces is such an important item in the development of the processes here described, that it is worthy of fuller explanation. Before color in concrete surfaces can be under artistic control, a technique must be developed which has for its medium the elements of the concrete itself. Although in problems involving appearance aggregate is by reason of its greater bulk the major element, and cement the minor, it is, nevertheless the color of the cement which is the natural color of normal concrete. The reason for this is that the cement is finely ground and deposits itself, paint-like over the surfaces of the aggregates and colors the whole mass. If, therefore, concrete is to receive its color from the cement paste, variation must be obtained by the addition of pigments to the cement following the well established practice of mixing paints; but if the aggregate is to be the source of color, the concrete must be so designed and manipulated as to deposit in the greatest possible amount of aggregate. Any great degree

Detail of Sixteenth Street entrance to Meridian Hill Park, Washington, D. C. Massive construction in which ornamental detail is well executed in concrete. Three textures are shown: fine on the reveal of the arch (left), medium on the panel of the wing wall (right) and coarse on the rusticated blocks (center). The blocks are precast, the wing wall is monolithic, cast in place. The color is uniform throughout.

Detail of secondary porch, Potomac Park field house, Washington, D. C. Cornice, columns and balustrade are of precast concrete, base is monolithic concrete cast in place, and walls of portland cement stucco on tile. All surfaces have the same color and texture.

of success can hardly be expected in coloring concrete through the cement. The choice of colors is restricted by chemical reaction with the cement which causes them to fade or change; depth of color is restricted by strength requirements of the concrete, which limits very closely the amount of pigment which may be added to the cement. Therefore with the choice of color limited by one requirement and the depth of color by another, the cement itself must remain dominant. On the other hand, in coloring concrete through the aggregate all such restrictions are removed, and colors may be obtained from white to black, through all the range of possible aggregates. An examination of drawings done in hard pastelles and of paintings of the impressionist school suggests a technique in coloring which is peculiarly adaptable to the coloring of concrete by means of the aggregate. In the pastelles, tones are produced by hatching and cross-hatching with lines of pure color without blending on the surface of the drawing; in the paintings, by spotting with pure colors one beside the other and without blending. In both cases the tones are effected by the blending of the light rays reflected from the picture to the observer. Wonderful depth and clarity of tone are characteristics of this school of coloring, and in it are to be found a great deal of exact knowledge and valuable precedent. When this knowledge is translated in terms of concrete aggregates, it is obvious that if the aggregates are carefully selected and carefully placed, all the elements are present for the successful coloring of concrete surfaces. The results obtained in practice bear out the theory given above, and there is every reason to believe that the aggregate is the proper source of color for concrete.

Hence it was a most important conception that a similar result might be obtained with stucco. The success of this depended, first, upon securing a suitable gradation of the stucco aggregate, and second, upon being able to apply such a mixture, once it were satisfactorily compounded. It was known at the outset that these mixtures would be harsh, therefore plasticity no longer played any part in the calculations.

The laboratory program was fairly simple. The plan consisted simply in working first with concrete mixes in miniature, in which the sizes of cement particles, sand particles and coarse aggregate particles were reduced from the normal sizes in the ratio of about 1:10, this being taken as the approximate ratio of the size of particles passing a No. 8 sieve to pebbles one inch in diameter. It was assumed that the density of such mixes would depend mainly on relative sizes of the component particles, with due allowance for the water content. If these mixes appeared to be satisfactory for the purpose, it was assumed that any reduction within the 1:10 ratio would also be satisfactory, and the actual reduction to be employed in compounding any given stucco mixture of this type would be as slight as the requirements of texture and the difficulties of application would permit. These experiments in the laboratory with the miniature concretes were very successful. Not the least important part of the laboratory work was the microscopic examination of the structures of these little concretes, which yielded many valuable suggestions for the gradation in size of particles, and for the proper proportions of the various sizes, to yield the desired effects in the treated surfaces.

South portico of the field house, East Potomac Park, Washington, D. C. The portico is of precast concrete and the building of portland cement stucco on tile. Both concrete and stucco are of the exposed aggregate type and are of the same color and texture.

The first attempt to apply the new product to a vertical wall was not wholly discouraging. Small areas were treated successfully, and eventually a portion of one of the new laboratories of the Bureau of Standards was coated with the exposed aggregate stucco. This example while it is not as free from imperfections as the more recent work, has attracted most favorable notice. Fortunately, the mechanics who were selected for this work developed a real interest in the new type of finish, and subsequently a pride in the results of their work, which made for very rapid progress in the development of the methods of application and treatment. New requirements in thoroughness of mixing, consistency, and control of the absorption of the undercoats were met, and other improvements in the general process were gradually introduced as essential parts of the routine. Not all of the problems have been solved, but there has been very gratifying progress in the comparatively short time that the new stucco has been applied commercially.

The writers believe that the work here described shows progress in the development of concrete and stucco as materials worthy of a place in the highest type of buildings or structures. It is to be noted especially that none of this work is an imitation of stone. Close inspection shows at a glance that it is concrete, with textures that vary widely, but always characteristic of concrete. Furthermore, the material may be cast in any form the architect may desire, with all details complete; no cutting, tooling or dressing is required other than the prescribed treatment of cleanly exposing the aggregate. Finally the material provides a medium for the expression of color in infinitely greater variety than that which obtains in the natural building stones.

In conclusion the writers would add a word about stucco. The new type of exposed aggregate finish cannot fail to arouse new interest in stucco, as a product, regardless of the nature and treatment of the finishing coat. The product should be more widely used, and, the reason it is not more widely used is that it has too often been applied by contractors or mechanics who consider it only as an outside plaster. This paper has attempted to convey the impression that cement stucco is more like concrete than plaster, and that plasticity is not essential. The point the writers wish to emphasize is that the art of applying durable stucco is very different from the art of plastering, and in their opinion, stucco will take the place it deserves among building products only when this fact is generally recognized.

REMARKS.

EMILE G. PERROT: I would like to ask Mr. Earley how he runs on the moldings and secures the texture that was shown in the slides he exhibited. Also how do they secure the aggregate surface on the precast columns?

J. J. EARLEY: The same general mixture and type of concrete exists in the core of the column as on the face. The only difference is the color value which the facing material has. Concrete for exterior and interior was placed at the same time. The thickness of the outside layer is about 3 inches. The moldings were applied as stucco.

To secure the color effect of the aggregate, forms were removed

from concrete when it had hardened sufficiently to hold aggregate particles in place but not sufficiently to prevent the coating of cement from being removed from their surface. In order to expose the surfaces, brushing and washing was done by using a diluted solution of muriatic acid. All of this work was done to architectural detail. There was no restriction to the detail because of the material used. Form and texture were predetermined. Therefore, such success as we had was a measure of the control possible over the material.

Some of the slides exhibited showed the yellow gravel, native to the vicinity of Washington. There is quite a range of color in this yellow, bordering from yellow ochre up to raw sienna. Combinations, of course, can be made from these deposits. We also heighten or thin, if it can be so expressed, the tone by the introduction of color spots. For example, the yellow gravel can be warmed in color by adding brown or red spots of suitable size and number. Likewise the yellow tone may be reduced by the introduction of green or blue spots. From a distance these are hardly discernible, but they have a very marked effect upon the tone in general. Two samples set side by side are quite different. We also use marble, feldspar and crushed granite.

The stucco mixture was prepared as ordinarily and then applied with a steel trowel, and the aggregates trowelled in by using the steel trowel as a float. We use both washing with water and washing with acid solution to obtain the required exposure of aggregate, depending upon the length of time the concrete has been hardening.

REPORT OF COMMITTEE ON PLASTERED AND GUNITE HOUSES

Among the many plans devised by engineers and constructors, stimulated to unusual activity by the demand for more and for better houses, there are a number which, departing from the conventional, and differing in detail, have certain fundamental ideas in common. These common ideas, in accordance with which this Committee has been asked to gather this group of designs, appear to be briefly:

First: Insulation against heat conductivity by the use of dead air spaces of greater or lesser extent, but positively isolated and non-communicating.

Second: Fulfillment of structural requirements to produce strength, firesafeness and permanence.

Third: The development of such methods as will allow versatility in design, both as to size and architectural treatment.

In working out the details of construction to meet these fundamental propositions, the designer has had wide latitude, and his tendency as influenced by his daily vocation is clearly shown in the manner in which he has approached the proposition. One is accustomed to building structures with Cement Guns, another is familiar with plaster contract work, another is an architect and another is a structural engineer. Each applies technical skill and practical experience in his own way to the solution of the common problem, with results that are interesting and valuable; but the knowledge and skill of all these has been utilized in the development of the plastered or "gunite" type of house which may be defined as follows:

The plastered or gunite concrete house is one having a reinforced concrete structural framework, either cast in place or shot with a cement gun and having comparatively thin exterior double walls of concrete formed by plastering or shooting concrete on expanded metal, or mesh reinforcement. This type may or may not have concrete floors and roof. If not wholly of concrete, "metal lumber" makes the best substitute. Wood floor joists and wood stud partitions should be used only when economy in first cost is demanded.

One of the greatest objections to monolithic concrete construction is the bother and expense of forms. This is particularly true of dwelling house construction because of its endless variety, with complication of openings, angles, etc. There can be no question but that the ultimate to be desired in concrete house construction is a design in which every piece that is erected remains put and forms a permanent, integral, necessary part of the structure.

Insulation is a matter which vitally affects the comfort of a house, as well as the cost of heating it. Control of heat loss and ventilation is fundamental to success in the design of a heating plant, and such control cannot be obtained with exterior walls having poor insulating qualities. Insulation of exterior walls of houses is also required to prevent condensation of moisture on the interior surface of these walls,

regardless of the type of construction. Masonry walled houses are always furred, lathed and plastered on the inside, thus producing an air space between the masonry wall and the interior of the house, which furnishes the required insulation to prevent a sufficient difference in temperature being established between the wall surface and the air within the house to cause condensation. Concrete houses, of whatever type, are no exception to this requirement for insulation, and the designers of this group make it possible to supply the requirements of insulation by including a dead air space in the wall proper. The plastered and gunite types have a concrete exterior wall about 2 inches thick, separated from the interior finish by a dead air space, as will appear by examining the various methods of construction described in this report.

Any air space in a wall to be effective must have no connection with the outside of the building, and should be limited to such width and arrangement as to prevent convectional currents of air being set up within the air space itself. The outside wall of the plastered or gunite house is usually only from 1½ to 2 inches thick, but this wall is reinforced in all directions by expanded metal or mesh reinforcement which is completely imbedded in the wall. The wall is moreover supported on all four sides by the reinforced concrete framework so that it is required to act merely as a "curtain" wall. Good workmanship will insure a very dense wall 1½ or 2 inches thick which is not only impervious to moisture under the most severe weather conditions, but also prevents any appreciable transfer of air between the dead air space and the exterior. While the wall itself possesses some insulating value, it is to be remembered that the entrapped air within the dead air space is depended on for insulation.

If a very high degree of insulation is desired, this type of construction allows the use of various insulating mediums, such as heavy waterproof building paper, corkboard, felt, etc., which can be applied in sheets directly to the inside surface of the outside wall.

The second fundamental requirement is fully met by this method of construction but an examination of building codes in various cities reveals the fact that the requirements of the construction of ordinary dwelling houses are based on familiar practice in the construction of masonry walls comprised of small units set in mortar, or on frame construction.

The plastered or gunite type of house, as above defined, may truly be said to be a new type of construction to most building commissioners and inspectors. It is not to be expected, therefore, that present building codes provide directly for the use of such construction. However, this type does fulfill the fundamental requirements of strength and fire-resistive qualities. The structural framework is of reinforced concrete cast in place or shot into place with a cement gun. The sizes and reinforcing of the various structural parts are easily varied to meet all specified load conditions and are matters of simple engineering design. The exterior walls are, of course, thin as compared with those specified for ordinary masonry bearing walls, but it should be borne in mind that this is an entirely different type of construction. The exterior walls of the plastered or gunite type of house have a reinforced concrete frame

which in conjunction with the reinforced thin slabs make strong and rigid bearing walls and have the elements of strength of the well known reinforced concrete floor. Lack of familiarity is, therefore, the only excuse for hesitation in allowing this type of dwelling house to be constructed within the fire limits of cities or in any other localities.

The results of such tests as are available on the fire-resistive ability of a double concrete wall such as above described, indicate its ability to withstand the 1-hour fire test without serious injury. It will be recalled that the usual building code requirement for the thickness of concrete covering over reinforcing for flat surfaces, such as in floors, is from $\frac{3}{4}$ to $1\frac{1}{2}$ inch, with an average of about 1 inch. This indicates at once that the exterior reinforced concrete wall, 2 inches thick, practically fulfills the usual building code requirement for fireproofing even for large fireproof buildings.

In the average dwelling house there is not enough combustible furnishings to produce a fire of sufficient intensity and duration to affect in any serious way the reinforced concrete framework of this type of building. A favorable insurance rate is, therefore, justified.

Another point that occurs to your committee in examining this group is the fact that there has been introduced an entirely new element of safety, elsewhere non-existent.

It will be noted that in all these types there is a form of wall construction consisting of relatively thin walls with relatively a very high degree of steel reinforcement, all thoroughly knit together into a strong unit. The effect is the same as that of wire glass. It may be cracked and broken, but it will not go to pieces. Not only should it be in a high degree cyclone and earthquake-proof, but it should be like wire glass, flame resisting.

The conclusions which your Committee reaches after examining the designs available in this group are as follows:

1. All structural requirements are fully met in the plastered or gunite type of house herein defined.

2. The framework and walls of this type are of fireproof material and are sufficient to withstand without serious injury any conceivable dwelling house fire.

3. It follows that building codes should allow this type of construction within the fire limit of cities, and that insurance rates should credit in full this type as fireproof construction in all portions where concrete is used.

4. The insulating qualities of the double wall produced by this type (or method) is sufficient to prevent condensation of moisture on the interior of exterior walls and insulating mediums can easily be applied to obtain any desired degree of insulation.

5. Concrete floors produce a thoroughly fireproof and sanitary structure. Concrete floors should preferably have embedded nailing strips or be covered with a layer of nail-coat to which a wood floor may be nailed or be covered by rugs, carpets, or special, easily removed floor coverings.

6. The use of plastered or gunite concrete houses lend themselves

to flexibility of design so that the architect is not hampered by any predetermined unit in working out the design of his building. Furthermore, he can have different texture finishes for the exterior walls and trim the building with wood porches, cornices and the like as is customary in the standard wood frame covered with stucco, while at the same time securing the fireproof qualities in the exterior of the wall construction with a minimum expenditure of material, which is about one-third of what a monolithic 7 inch wall would be, thus conserving materials, and operating to keep the cost of construction at a point that more houses can be built for a given amount of money than would be the case where heavy masonry walls are used.

7. The particular type which a builder should select out of this group will depend on the availability and relative cost of materials, power, and of skilled artisans and common labor.

8. All types are good in design and will make superior houses, if the work is properly executed.

9. A concerted effort should be made by the parties in this group to get tests made by the Underwriters' Laboratories, so as to get definite and favorable rulings on city building codes and insurance rates.

COMMITTEE ON PLASTERED AND GUNITE HOUSES

Emile G. Perrot, *Chairman*, Philadelphia
J. V. Schaefer, *Secretary*, Chicago
Wharton Clay, Chicago
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CONCRETE STUD AND CEMENT STUCCO CONSTRUCTION

BALLINGER & PERROT SYSTEM

BALLINGER & PERROT, PHILADELPHIA.

Modern practice has proved it economical to construct commercial and industrial buildings by using supporting piers or columns of reinforced concrete for the exterior walls, with spandrel beams at each floor level, filling in the intervening wall surface with a thin curtain wall.

A partly completed house at South Ardmore, Pa., being erected according to the Ballinger & Perrot System.

The same principle applied to walls for houses promotes economy and speed of erection.

This system is an improvement over the standard wood frame construction covered with metal lath and stucco. It introduces concrete studs and plates into the wood frame, which with the stucco wall forms a "concrete cage" possessing economies in design of a light framework by comparison with solid masonry walls. The system utilizes trade practices and materials found in all parts of the country and obviates the need of training workers in a new trade.

Complete fireproofness is not claimed for this system of construc-

Detail of house at So. Ardmore, Pa. Exterior wall surface is prepared to receive the stucco finish. Ballinger & Perrot System.

tion, but the concrete studs and beams at story height and the plastered or gunite walls offer security against collapse from a fire originating within and from the spread of fire through exterior walls.

No departure need be made from the usual wood joist for floors and wood studs for partitions unless entirely fireproof construction is desired. The method of building after this system is as follows:

The cellar is excavated and stone or concrete foundation walls are built. The first-floor joists are then set in place on the foundation wall. On these a typical wood frame, with certain modifications, consisting of studs, joists and rafters, is erected in the usual manner of building the skeleton of a frame house. Every fourth stud is doubled, with a 3 by 4 inch space between. At the second floor level a ledger board with bottom attached is placed over the studs, the bottom board being cut out over the space between the double studs. On top of this ledger board, or stringer, the second floor joists are set, then the second-story studs with the wall plate, built similar to that at the second floor level. The roof rafters resting on the wall plate are wood. When this wood frame has been completed and the roof is on, heavy waterproof paper is nailed to the outside of the exterior wall studs, leaving the space between the doubled studs as well as the outside of the ledger beams, open to receive steel rods and concrete. The metal lath, or concrete reinforcement, is stretched over the waterproof paper. The wood studs act in the dual capacity of supporting the cement stucco while it is being applied and as furring in the finished building. A $1\frac{1}{2}$-inch coating of cement stucco

is applied to the exterior, first filling up the spaces forming the studs and horizontal ledger beams with cement mortar. The concrete studs are continuous from foundation to roof, and with the reinforced concrete ledger beams produce a rigid concrete frame.

The rapidity with which this type of house can be erected is dependent only upon the number of workmen employed at any one time.

The vertical concrete studs carry all the load, so that there is no shrinkage or settlement to contend with in this monolithic structure.

The party walls merely have a skim coat of white plaster applied to the cement finish, which makes a saving of 20 per cent on this wall alone, as the "scratch" coat is omitted. The saving on the exterior walls is 33 1/3 per cent.

Floors are of wood, upon wood joists, and the partitions are of wood studs, lathed and plastered in the customary manner. Substitutes for plastering, such as wall boards and composition boards, are not satisfactory, because in spite of their lower first cost, they buckle as the building ages, and the numerous joints permit vermin to enter and breed inside the walls and partitions.

By standardizing the details of houses and applying well organized methods in their erection, group houses varying from four to ten in number can be completed for less cost than the customary type built of 8-inch brick exterior and party walls.

THE DONALDSON SYSTEM OF CONCRETE HOUSE CONSTRUCTION WITHOUT THE USE OF FORMS.

By the use of the Donaldson System a building is erected of monolithic reinforced concrete without the use of forms. Ribbed expanded metal or mesh is utilized as forms for the construction of columns, beams, floors, walls, stairs, porches, roofs and all details. The expanded metal or mesh thus serves the double purpose of forms and reinforcement.

Columns, beams and floor slabs are cast in place using a 1:2:4 quaky mix. The concrete works through the mesh and forms a button that engages the steel. Exhaustive tests made in Philadelphia, personally directed by George Warner of the Bureau of Building Inspection in 1916, and tests by the manufacturers of rib expanded mesh have proved that slabs cast in this manner develop great strength. There is no waste of concrete in columns, beams, floors and roof slabs, for the amount coming through the mesh acts as a scratch coat for plastering.

Exterior Walls

A ribbed reinforcing mesh is erected as the building goes up. Since the load is carried on columns and beams, the outside wall is merely a curtain wall. It is plastered four coats to about 2 inches thick with a portland cement plaster of 1:2½ mixture with a small amount of hydrated lime. These four coats include the outside finish, which may be done in a splatter dash float finish, dry rock dash, or stucco. The exterior wall as described with stucco finish, is in no sense stucco construction but a 2-inch reinforced concrete wall.

Three inches inside of the outside walls a slot is left in the floor about $\frac{7}{8}$-inch deep in which the end of ribbed metal lath is dropped and fastened securely to the bottom of the ceiling cove and column sides and plastered with a scratch and brown coat of cement plaster and a finished coat as desired. The inner wall lath may be back plastered before set in place, thus completely covering all metal throughout the building. A dead air space of from two to three inches between inner and outer walls is obtained, assuring the elimination of dampness and desired insulation. There is no connection between inner and outer wall except at columns and beams, but for an exceptionally high ceiling, angles may be fastened to the back side of the inner lath to act as stiffeners.

Inside Partitions

These are formed by erecting a single reinforcing mesh, allowing it to extend into the beam about four inches, thus fastening it at the top, while the $\frac{7}{8}$-inch slot in the floor receives the bottom of the mesh. The partition is then plastered with a three-coat cement plaster and a finish coat applied to each side, making a 2-inch thick partition monolithic with the remainder of the building.

Stair Construction

Inside and outside stairs are formed by using an expanded, ribbed, metal lath with a stringer of the same material, or it may be erected between two walls without a stringer. Portland cement plaster is applied, first to the top of the tread and the face of the riser, then back plastered underneath, after which the finish coat is applied to the top surface. Stairs may be built in this manner a great deal cheaper than wooden stairs. Stairs are also monolithic with the building and can be faced if desired with wood trim. Stairs built after this method over two years ago are perfect in every way. It is a very simple matter to erect spiral stairs in this manner.

A group of Donaldson System Houses at East Youngstown, Ohio.

ROOF CONSTRUCTION.

Reinforced concrete roofs of any shape or design are easily built under this system. The roof beams are cast in place and are tied into the columns, producing a rigid frame. Roof slabs are monolithic with the roof beams and thus produce a continuous roof structure. By using a mix developed for this purpose for a top coat, a nailing surface is obtained for attaching any desired roof covering. Long span roof trusses may be constructed with facility according to this system.

FLOOR FINISHES

A special top coating of cement mix may be used which is troweled smooth, waxed and colored as desired. Or a finished floor of wood can be securely nailed directly to this surface.

INSIDE FINISH

The base may be cement plaster, monolithic with the walls, finished smooth and stained or grained to imitate wood, at a cost of about one-fourth that of pine; or ordinary trim may be used in the base and casings, grounds being placed to receive the trim.

Flower boxes may be built as a part of the building. Porch columns, rails, newels and balustrades may be erected any shape or style desired and the cost in most cases will be less than if built of wood.

SUMMARY

By this system unlimited architectural range is allowed. It is as easy to build 100 houses of 100 different designs as to build all of the same design. The reinforcing mesh is easily formed in the field, requiring but a pair of snips and wire pliers to do the work. Shop drawings and specifications are furnished to the manufacturer of the reinforcing mesh for cutting so that it is sent to the job ready cut, bundled and plainly marked for erection. This eliminates waste. Additional reinforcement required in girders, beams and columns is supplied with ordinary bars where needed. The mesh in beam construction is bent up to act as a form for the sides of the beam, and acts as continuous shear reinforcement. The mesh in column construction provides continuous hoop reinforcing.

This system has been used for two years in the building of residences, apartment houses and warehouses. The required structural strength is furnished by the reinforced concrete columns, beams, floor and roof slab, all of which are concreted before any of the outside walls are completed, as in the erection of a skeleton steel frame for an office building.

The following are examples of the use of the Donaldson System:

Atlanta, Ga., for the Realty Trust Co., of Youngstown, Ohio.

Industrial housing for General Fireproofing Co., Youngstown, Ohio.

Warehouse work and industrial housing, Standard Portland Cement Co., Leeds, Ala.

Industrial housing and warehouse construction for Eva Jane Cotton Mills, Scylacauga, Ala.

Industrial housing and warehouse construction, Avondale Cotton Mills, Birmingham, Ala.

A large community building for Avondale Cotton Mills, Birmingham, Ala.

Store buildings and filling stations for the Wofford Oil Co., Birmingham, Ala., and Atlanta, Ga.

TRAYLOR-DEWEY CONTRACTING CO.'S SYSTEM OF GUNITE BUILDING WALL CONSTRUCTION.

The method devised by the Traylor-Dewey Contracting Co., of Allentown, Pa., is being used by one of its officers in building his new residence and may be briefly described as follows:

Cellar walls and foundations are constructed of concrete by ordinary methods. Upon this foundation a 2 by 6 inch runner is laid flatwise so that the floor beams will extend about 3 inches beyond its outside edge.

Wall Forms

These units consist of a light framework over which two-ply tar paper is fastened to furnish a backing against which the outside wall is "shot" or applied and which carries the interior plastered finish. The framework consists of 2 by 4 inch top and bottom pieces with 1-inch thick uprights and cross pieces and with No. 10 wires horizontal between cross pieces stretched and stapled to the verticals. When the forms are in place, the 2 by 4 bottom cross pieces extend under the ends of the floor beams and butt against the 2 by 6 inch runner on the foundation.

The forms are so placed as to leave a 4-inch space between units for the purpose of forming concrete studs. Each complete form unit is connected to its mate by a 1 by 6 inch board, providing the back form for the concrete stud.

Each stud is reinforced by two $\frac{1}{2}$-inch round rods passing through $\frac{5}{8}$-inch holes punched in angle clips fastened to the 1 by 6 strip. Each stud is anchored to the foundation by means of a short $\frac{3}{4}$-inch anchor bar previously cast in the concrete foundation and left to project into the stud about 6 inches.

The inner surfaces of the corner studs are formed by the sides of the adjoining form units, the angle clips being attached to the side members of the form units. Three $\frac{1}{2}$-inch bars are used in each corner stud.

Floor Beam Supports

After setting up the first story form units, a 2 by 6 inch timber is placed edgewise on top of the 2 by 4 top members of the form units, with its inner face flush with the inner edge of the 2 by 4's. This

serves in part as a support for the floor beams of second story and in part as backing against which to shoot the gunite.

The frame work for the interior partitions is then erected and the floor beams for the second story put in place, their ends resting upon the 2 by 6 and extending two inches beyond its outer face. The spaces between the ends of the floor beams are then filled in with 1 by 8 inch boards placed with outer faces flush with the 2 by 6 immediately below. A form is thus made for a reinforced gunite beam, reinforced by $\frac{1}{2}$-inch bars, which not only serves as a support for the floor beams, but in connection with the gunite between ends of floor beams, as an effective firestop between the first and second stories.

The second story form units are constructed and erected in the same manner as those of the first story with practically the same arrangements for roof supports as described for the floor supports of the second story.

"Steelcrete" reinforcement is firmly attached to the forms by means of special mesh clamps which not only secures the reinforcement, but holds it away from the tar paper surface about one-half inch. In all cases where the reinforcement crosses studs it is firmly wired to the outside stud reinforcing bar.

Gunite Exterior Walls

The gunite exterior walls are $1\frac{1}{2}$ inch thick composed of 1 part portland cement and 3 parts sand or crushed slag. Special wooden strips are used as may be necessary to insure square and true corners and leave a rough gunite finished surface.

Interior Finish

To the strip forming the back of the studs and to the inner edge of the uprights of the form units, which are flush with stud strips, metal lath is attached and plaster applied by the ordinary hand methods, thus leaving a 5-inch air space between the inner and outer walls with an effective gunite fire stop at floors.

Advantages

Hollow enclosing walls constructed in the manner described utilize the minimum amount of lumber and other materials and produce a well insulated structure.

The tar paper backing of the form units serves not only as a backing against which to apply the gunite but as an insulator as well.

CELLULAR GUN-CRETE HOUSE

As Advocated by Cement Gun Construction Co., Chicago, Ill.

The Gun-Crete house had its origin in the desire to use the well-known work of the cement gun in house construction.

Name

The word *Cellular* is used because Gun-Crete house walls are built up of dead air cells, the best heat insulator known; and *Gun-Crete* because the material is concrete made with a cement gun.

Walls

Gun-Concrete walls consist of reinforced concrete outer walls all shot in place at one operation with cement guns operating at 35 pounds pressure per square inch, with a mixture of 1 part of portland cement and $3\frac{1}{2}$ parts coarse sand. No forms are used. A tarred felt fabric stiffened with wire is bent into shape and stapled to 1 by 2 inch wood furring strips regularly spaced which serve as a backing to shoot against and as an additional insulation. The furring strip is integral with each stud and holds the inner plastered wall, which also is backed with a layer of tarred felt.

The wall elements are shown in the detail of a typical Gun-Crete house on the opposite page. They consist of:

A. An outer reinforced concrete wall integral with reinforced concrete studs.

B. An inner plastered wall, preferably of cement plaster, so it can be washed down with a hose.

C. A dry wood strip positively separating inner and outer wall with no metallic connection between them, preventing any conduction of heat or moisture from one wall to the other.

D. An air space sealed on all sides and lined with non-conducting felt.

Floors

Floor joists are of reinforced concrete, precast to accomplish speed of construction. They are spaced in line with studs with reinforcement interlacing.

Floors are of reinforced gunite with reinforcement interlacing with wall reinforcement. They may be covered with wood floors, if desired.

Trim

Doors and windows may be of wood or metal, as desired.

Interior

Plumbing, lighting and heating are as for other construction. The wall cells may be used for concealed wiring without danger of fire.

Roof

The Gun-Crete house is complete with a flat concrete roof, though any kind of a roof may be built.

Advantages of a Gun-Crete House

1. It is fire resisting.

2. It is sanitary. Vermin cannot propagate or migrate in it. If vermin or contagious disease germs get in, the house may be washed out with a hose, or fumigated.

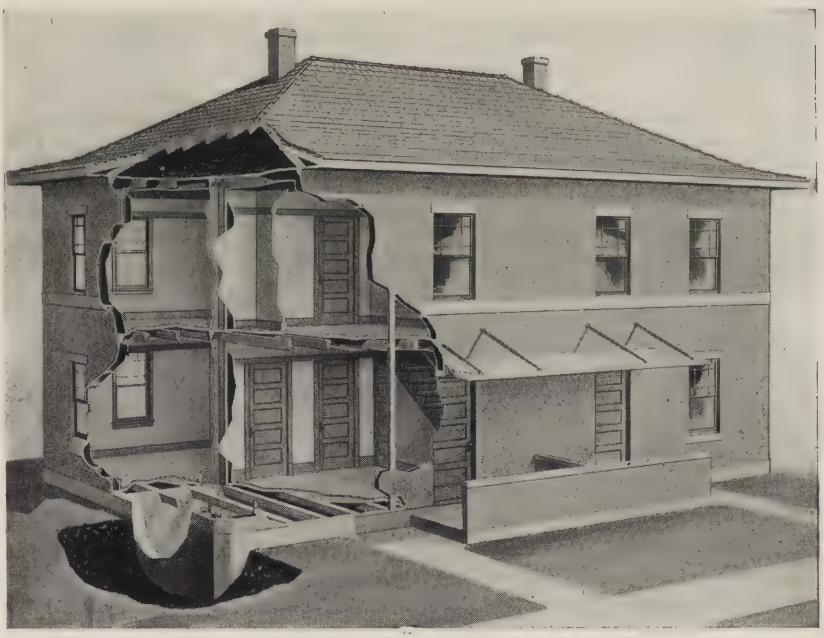
3. It is stormproof. An earthquake or a cyclone might distort it, but it cannot fall down, nor be blown to pieces.

4. It is made largely of local material.

5. When built in quantity, it is relatively inexpensive and cost of upkeep is low.

6. It can be built largely with unskilled labor.

7. It can be built quickly and without forms.



Perspective view cut away showing typical Gun-Crete house.

REMARKS.

CORNELIUS LEENHOUTS: Years ago I had occasion to remove plaster and concrete applied to expanded metal because it had started to break loose. I found nothing but streaks of rust where the expanded metal had been. What assurance have you that expanded metal close to the surface of the exterior wall and fitting against a wood form where moisture can get at it will not be rusted out in the course of ten years?

C. I. DEWEY: In 1910, when we were working out the cement gun, we coated several buildings in Whitestone, L. I., which is right on Long Island Sound, and exposed to salt air. That work is as perfect today as when finished. A 1:3 mixture properly applied with a cement gun to the thickness of an inch is absolutely watertight. We are doing waterproofing of reservoirs and tunnels and will take contracts to waterproof against a hundred foot head with 1 inch of gunite and absolutely guarantee the job. We depend entirely on the density of the material. We do not use any waterproofing material of any kind whatever.

C. W. DONALDSON: Up to a few years ago I built reinforced concrete construction in the old-fashioned way. Now I am using reinforcing as a formality. We have used many of the ribbed meshes for a number of years for reinforcement with the structural steel frame. I am using a mesh in column, beam, floor and roof construction and putting in a curtain wall on the outside. The load is all carried on the beams and columns, giving a dead air space between inner and outer walls.

I should like to read a letter to you:

"Birmingham, Ala., Dec. 3, 1919.

Donaldson Concrete Construction Company,
420 Jefferson County Bank Bldg.,
City.

Attention Mr. Donaldson.

Dear Sir:

After inspecting work done under the Donaldson System of Reinforced Concrete Construction without the use of forms in the Birmingham District, I have become convinced that your system of construction is thoroughly practical and offers a great saving in cost as well as in time over any other method in reinforced concrete construction.

I am instructing my engineering department to submit to your office data for bridge work to be designed under your system of construction, and feel that it will effect a very considerable saving over the form method.

Yours truly,
S. R. BATSON.

(Member Federal Highway Council, State Highway Commissioner of Alabama; Highway Engineer of Jefferson County, Consulting Engineer for the City of Bessemer.)"

Wall costs in Chicago today on residence construction can be let under my system for about 27 cents a foot, giving you a 2-inch reinforced concrete wall.

REPORT OF COMMITTEE ON CONCRETE BLOCK HOUSES

In block, brick and structural tile made of concrete, we have three building materials which have survived the most severe criticism and prejudice of their earlier years. Houses built of these units more than a score of years ago are still standing and to all appearances are practically as good as when erected.

Concrete building units are now recognized for their true worth as structural materials. Manufacturers have accepted all criticisms as constructive and by constant effort to improve their product have acquired considerably more skill in making these units than had the pioneers in the business.

The only valid objection which can be held against the earlier structures is their appearance. The effort to simulate cut stone has been the chief cause of prejudice. Had skilled artisans recognized the structural possibilities of concrete block when they were introduced and used their talent to direct the work, no doubt this objection would have been forestalled. Today, building units are being developed and manufactured which are unsurpassed by any other masonry material, either in appearance or structural soundness.

One of the outstanding merits of concrete block and tile is the insulation afforded by the air space in the wall. In making a hollow unit, the manufacturer has achieved a double purpose, he not only has reduced the amount of material that would be necessary for solid wall construction, but has also furnished a good insulating medium. Houses constructed of these concrete building units are comfortable at all times, cool in summer and easily heated in winter.

Speed of erection, a point always foremost in the minds of contractors and builders, is one of the chief advantages of these easily handled units.

One of the accepted practices of the building industry is to use those materials nearest at hand. Concrete aggregates, common to most localities, constitute in bulk and weight, the principal materials used. Thus the use of concrete building units reduce the demand on our transportation systems to a minimum.

At present, approximately 4,000 concrete products plants are in operation in the United States. No great outlay of capital is necessary to build and equip temporary products plants, such as would be suitable to establish at points where extensive building operations are in progress. In such locations quick delivery of manufactured units to the building site is assured. A well equipped plant operates the year 'round and a reserve stock of concrete building units may be made during the winter months for the following summer's use.

So numerous are the treatments to which the surface of these units may be subjected that they may be used for the construction of every house in a city block without repetition of surface texture or color. The design of every house in a community may be varied with these flexible units without materially increasing the cost.

The substantial appearance of these concrete block residences impresses one with their permanent character.

The demand today is for a material with which individuality can be expressed and at the same time one which meets all the requirements of permanence and economy. Concrete building units more readily meet these requirements than any other form of permanent building unit.

The concrete building units herein referred to are more specifically defined in the report of Sub-Committee B. This report treats the entire subject of houses built of concrete building units in a general way as the details are fully discussed in the reports of the various Sub-Committees which follow.

COMMITTEE ON CONCRETE BLOCK HOUSES

R. F. Havlik, *Chairman*, Mooseheart, Ill.
E. S. Hanson, *Secretary*, *Chicago*
George Barriball, Cleveland
A. L. Benshoof, Elliott, Iowa
Edw. D. Boyer, New York
Gilbert Cooper, Joliet, Ill.
George Cuozzo, Bangor, Me.
Frank Deni, Mooseheart, Ill.
W. J. Deutsch, Buffalo, N. Y.
J. C. Donaldson, Des Moines
S. L. Ekholm, Cadillac, Mich.
E. Fellabaum, Toledo, Ohio
J. E. Freeman, Chicago
G. M. Friel, Columbus, Ohio
W. R. Harris, Chicago
J. K. Harridge, Chicago
W. G. Kaiser, Chicago
H. D. Kerr, Chicago
F. J. Kinzinger, Windsor, Ont.
H. G. Krum, St. Paul
F. M. Leach, Detroit
Robert Martin, Lansing, Mich.
Urban J. Meuer, Madison, Wis.
A. C. Newberry, Cleveland
A. H. Olmstead, New York
E. F. Olsen, Rock Rapids, Iowa
Warren A. Rogers, Cleveland
George Saffert, New Ulm, Minn.
Adolph Schilling, Haddon Heights, N. J.
J. D. Stoddard, Detroit
A. G. Swanson, Omaha, Nebr.
M. Wetstein, Cincinnati
L. P. Willsea, Rochester, N. Y.
S. F. Wightman, Detroit

REPORT OF SUB-COMMITTEE A— RECOMMENDED PRACTICES FOR CONCRETE BLOCK AND TILE CONSTRUCTION

In the development of a code of Recommended Practice the following points should be considered:

1. Specifications and building regulations for concrete block and tile.
2. The composition, preparation and use of cement mortars.
3. Types of mortar joints and approved thicknesses.
4. Water-proofing of foundation walls below grade.
5. The use of split sills and lintels.
6. Suggestions for protecting sills, lintels and other projecting portions from breakage and spattering during construction.
7. Methods of cleaning the wall.
8. Plastering with or without furring and lathing.

Specifications and Building Regulations

Concrete block and tile used in house construction should meet the requirements of the standard specifications and building regulations adopted by the American Concrete Institute, and as these may be amended from time to time. These are as follows:

AMERICAN CONCRETE INSTITUTE STANDARD NO. 10

Adopted by Letter Ballot, April 10, 1917

Standard Specifications and Building Regulations for Concrete Architectural Stone, Building Block and Brick

1. Concrete architectural stone, building block and tile for solid or hollow walls and concrete brick made in accordance with the following specifications and meeting the requirements thereof may be used in building construction.

2. *Tests.* Concrete architectural stone, building block for hollow and solid walls and concrete brick must be subjected to (a) Compression and (b) Absorption tests. All tests must be made in a testing laboratory of recognized standing.

3. *Ultimate Compressive Strength.* (a) Solid concrete stone, building block and brick. In the case of solid stone, block and brick, the ultimate compressive strength at 28 days must average not less than fifteen hundred (1,500) lb. per sq. in. of gross cross-sectional area of the stone as used in the wall and must not fall below one thousand (1,000) lb. per sq. in. in any test.

(*b*) *Hollow and two piece building block.* The ultimate compressive strength of hollow and two piece building block at 28 days must average one thousand (1,000) lb. per sq. in. of gross cross-sectional area of the block as used in the wall, and must not fall below seven hundred (700) lb. per sq. in. in any test.

4. *Gross Cross-Sectional Areas.* (a) Solid concrete stone, block

and brick. The cross-sectional area shall be considered as the minimum area in compression.

(*b*) *Hollow building block.* In the case of hollow building block, the gross cross-sectional area shall be considered as the product of the length by the width of the block. No allowance shall be made for the air space of the block.

(*c*) *Two piece building block.* In the case of two piece building block, if only one block is tested at a time, the gross cross-sectional area shall be regarded as the product of the length of the block by one-half of the width of the wall for which the block is intended. If two block are tested together, then the gross cross-sectional area shall be regarded as the product of the length of the block by the full width of the wall for which the block is intended.

5. *Absorption.* The absorption at 28 days (being the weight of the water absorbed divided by the weight of the dry sample) must not exceed ten (10) per cent when tested as hereinafter specified.

6. *Samples.* At least six samples must be provided for the purpose of testing. Such samples must represent the ordinary commercial product. In cases where the material is made and used in special shapes and forms too large for testing in the ordinary machine, smaller specimens shall be used as may be directed. Whenever possible the tests shall be made on full sized samples.

7. *Compression Tests.* Compression tests shall be made as follows: The samples to be tested must be carefully measured and then bedded in plaster of paris or other cementitious material in order to secure uniform bearing in the testing machine. It shall then be loaded to failure. The compressive strength in pounds per square inch of gross cross-sectional area shall be regarded as the quotient obtained by dividing the total load applied in pounds by the gross cross-sectional area, which area shall be expressed in square inches computed according to Article 4.

When such tests must be made on cut sections of block, the pieces of the block must first be carefully measured. The samples shall then be bedded to secure uniform bearing, and loaded to failure. In this case, however, the compressive strength in pounds per square inch of net area must be obtained and the net area shall be regarded as the minimum bearing area in compression. The average of the compressive strength of the two portions of block shall be regarded as the compressive strength of the samples submitted. This net compressive strength shall then be reduced to compressive strength in pounds per square inch of gross cross-sectional area as follows:

The net area of a full sized block shall be carefully calculated and the total compressive strength of the block will be obtained by multiplying this area by the net compressive strength obtained above. This total gross compressive strength shall be divided by the gross cross-sectional area as figured by Article 4 to obtain the compressive strength in pounds per square inch of gross cross-sectional area.

When testing other than rectangular block, great care must be taken to apply the load at the center of gravity of the specimen.

8. *Absorption Tests.* The sample shall be first thoroughly dried to a constant weight at a temperature not to exceed two hundred and twelve (212) degrees Fahrenheit, and the weight recorded. After drying the sample shall be immersed in clean water for a period of forty-eight hours. The sample shall then be removed, the surface water wiped off, and the sample re-weighed. The percentage of absorption shall be regarded as the weight of the water absorbed divided by the weight of the dry sample multiplied by one hundred (100).

9. *Limit of Loading.* (a) Hollow walls of concrete building block. The load on any hollow walls of concrete block, including the superimposed weight of the wall, shall not exceed one hundred and sixty-seven (167) lb. per sq. in. of gross area. If the floor loads are carried on girders or joists resting on cement pilasters filled in place with slush concrete mixed in proportion of one (1) part cement, not to exceed two (2) parts of sand and four (4) parts of gravel or crushed stone, said pilasters may be loaded not to exceed three hundred (300) lb. per sq. in. of gross cross-sectional area.

(*b*) *Solid walls of concrete block.* Solid walls built of architectural stone, block or brick and laid in portland cement mortar or hollow block walls filled with concrete shall not be loaded to exceed three hundred (300) lb. per sq. in. of gross cross-sectional area.

10. *Girders and Joists.* Wherever girders or joists rest upon walls in such a manner as to cause concentrated loads of over four thousand (4,000) lb. the block supporting the girders or joists must be made solid for at least eight (8) in. from the inside face of the wall, except where a suitable bearing plate is provided to distribute the load over a sufficient area to reduce the stress so it will conform to the requirements of Article 9.

Any house design, whether on rigid rectangular or gracefully curved lines, can be worked out successfully with concrete block. This is one of more than 50 concrete block buildings at Mooseheart Industrial Institute, Mooseheart, Ill.

One of 349 concrete block houses at Morgan Park, Minn., built by the Minnesota Steel Company for the housing of its employes.

When the combined live and dead floor loads exceed sixty (60) lb. per sq. ft., the floor joists shall rest on a steel plate not less than three-eighths ($\frac{3}{8}$) of an inch thick and of a width one-half to one inch less than the wall thickness. In lieu of said steel plate the joists may rest on a solid block which may be three (3) or four (4) in. less in wall thickness than the building wall, except in instances where the wall is eight (8) in. thick, in which cases the solid block shall be the same thickness as the building wall.

11. *Thickness of Walls.* (a) Thickness of bearing walls shall be such as will conform to the limit of loading given in Article 9. In no instance shall bearing walls be less than eight (8) in. thick. Hollow walls eight (8) in. thick shall not be over sixteen (16) ft. high for one story or more than a total of twenty-four (24) ft. for two stories.

(b) Walls of residences and buildings commonly known as apartment buildings not exceeding four stories in height, in which the dead floor load does not exceed sixty (60) lb. or the live load sixty (60) lb. per sq. ft., shall have a minimum thickness in inches as shown in Table 1.

TABLE I.

No. of Stories	Basement in.	First Story in.	Second Story in.	Third Story in.	Fourth Story in.
1.....	8	8	..	..	..
2.....	10	8	8	..	..
3.....	12	12	10	8	..
4.....	16	12	12	10	8

12. *Variation in Thickness of Walls.* (a) Wherever walls are decreased in thickness the top course of the thicker wall shall afford a solid bearing for the webs or walls of the course of the concrete block above.

13. *Bond and Bearing Walls.* Where the face wall is constructed of both hollow concrete block and brick, the facing shall be bonded into the backing, either with headers projecting four (4) in. into the brick work, every fourth course being a header course, or with approved ties, no brick backing to be less than eight (8) in. thick. Where the walls

are made entirely of concrete block, but where said block have not the same width as the wall, every fifth course shall overlap the course below by not less than four (4) in. unless the wall system alternates the cross bond through the wall in each course.

14. *Curtain Walls.* For curtain walls the limit of loading shall be the same as given in Article 9. In no instance shall curtain walls be less than eight (8) in. in thickness.

15. *Party Walls.* Walls of hollow concrete block used in the construction of party walls shall be filled in place with concrete in the proportion and manner described in Article 9.

16. *Partition Walls.* Hollow partition walls of concrete block may be of the same thickness as required in hollow tile, terra cotta or plaster block for like purposes.

MORTARS

Unless carefully made, mortar joints are likely to be the weakest portions of a concrete block or tile wall.

The essentials of a good mortar joint are:

1. It should be dense and non-absorbent.
2. It must have sufficient compressive strength to withstand designed pressure in the wall without crushing.
3. It must attain strength rapidly.
4. It must be reasonable in cost and easily obtainable.
5. It must possess good working qualities.
6. It should be of good appearance.
7. It should be permanent.

Portland cement mortar meets these requirements and should be specified for concrete block and tile wall construction.

INGREDIENTS OF PORTLAND CEMENT MORTAR.

The ingredients of portland cement mortar are portland cement, sand and water. Usually a limited amount of hydrated or well-slaked lime is included. (See paragraph on "Proportions".)

Sand

Sand used for mortar should be hard, clean, free from vegetable matter and contain not to exceed seven (7) per cent by volume of clay or loam. The particles should be well-graded and range in size from fine up to those which will just pass through a screen having 4 meshes to the linear inch. Most masons prefer that the coarse particles predominate, claiming that coarse sand produces a more workable mortar. Sand which is not clean should be washed before using.

Cement

Any standard brand of portland cement may be used which meets the specifications for portland cement adopted by the American Society for Testing Materials. Cement should be kept in a dry place until used. Cement which contains lumps which can not be crushed with the fingers should not be used.

Water

Water should be clean, free from acids and alkali. In general it can be stated that water which is fit for drinking is satisfactory for cement mortar.

Lime

Only well-slaked or hydrated lime should be used. Lime is added to the mortar to impart to it better working qualities, thereby reducing the cost of labor in laying a given section of wall. Care should be observed not to add more lime than specified in the paragraph under "Proportions," otherwise the strength of the mortar may be materially diminished.

Proportions

Among masons there is a wide variation in the ratio of cement and sand used in making mortar; some prefer as rich a mixture as equal parts of cement and sand, while others use a mortar containing three times as much sand as cement. A proportion of 1 sack of cement to 2 cubic feet of sand will be found satisfactory under most conditions. A mixture containing in excess of 3 cubic feet of sand for each sack of cement is not recommended. Hydrated or slaked lime may be added to the mortar in an amount not to exceed 25 per cent by volume of the amount of cement in the mixture.

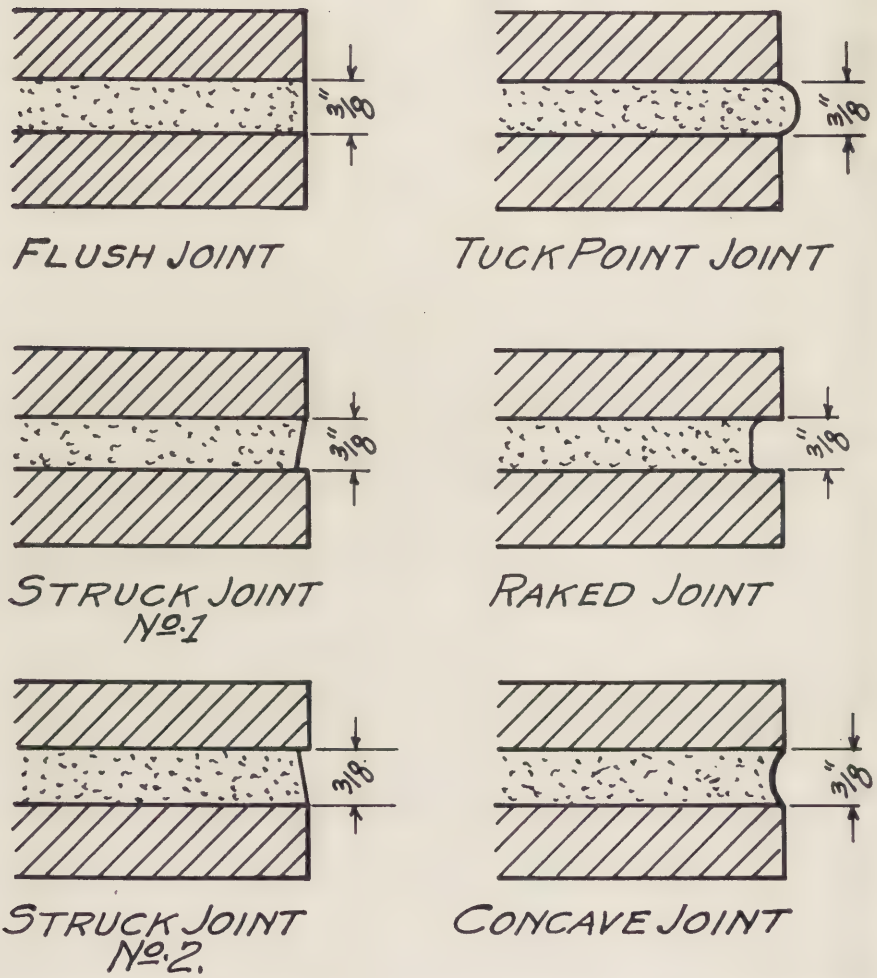
Mixing

The usual method is to mix the cement and sand dry until the resulting mixture is uniform in color and of like character throughout. Hydrated lime may be incorporated in the mixture simultaneously with the cement and sand. When lime putty (slaked lime) is used it is customary to dissolve the putty to a creamy consistency in water and then use this lime water when mixing the mortar. The mortar may be either mixed by hand or by mechanical means. In many cases hand mixing is practiced as the workmen can readily tell when the mass has acquired the proper consistency to obtain the best working qualities. Only as much water should be added as will after thorough mixing, produce a mixture of such plasticity as will work to best advantage.

It is best to mix only a small batch of mortar at a time (say enough for 30 minutes work). Mortar which has stiffened must not be remixed with water to impart to it workable qualities again. This process is commonly referred to as "retempering" and should not be permitted.

Mortar Colors

Colored mortars have never become very popular. For high class structures the natural cement colors have been preferred. None but finely ground mineral colors should be used for making colored mortars. The amount which may be used should never exceed 10 per cent by weight of the cement in the mixture. Extreme care should be taken that successive batches of mortar contain exactly the same proportions of cement, sand, coloring matter and water, otherwise the mortar will not be uniform in color.



Six types of mortar joints commonly used in laying up concrete block, brick and tile units.

MORTAR JOINTS

Thickness

Mortar joints, both horizontal and vertical, should average $\frac{3}{8}$ inches in thickness. In no instance should the joint be less than $\frac{1}{4}$ inch thick.

Application

A good bond between the mortar and the block is essential. To accomplish this end, mortar should be applied with force. For best results both ends of the block should be buttered. The horizontal or supporting section of the block should be entirely covered with mortar.

Quite a number of styles of joints are in common use. Among these are:

Flush Joint	Tuck Point Joint
Struck Joint No. 1	Raked Joint
Struck Joint No. 2	Concave Joint

The *Flush joint* as its name implies, is made by striking the mortar off flush with the wall surface. Except where the block are to be covered with stucco, the flush joint is not recommended because of its porousness and openness.

Struck Joint No. 1 is made by drawing the trowel along the joint with the blade resting on the edge of the block below the joint. In making struck joint No. 2 the operation is the same except that the blade of the trowel glides on the edge of the block above the joint. The latter is preferable because it provides a more weather proof joint. It is often called a weather joint.

The *Tuck Point Joint* is seldom used and it not recommended. This joint is formed by a special tool producing a joint which projects beyond the wall surface.

The *Concave Joint* is made by drawing a pointing tool along the joint producing a concave surface. This operation compacts the mortar producing a dense watertight joint. It is the type of joint recommended as most practical for concrete block houses which are not intended to receive a stucco finish.

The *Raked Joint* is produced in a manner similar to the Concave Joint. Depth should not exceed $\frac{1}{4}$ inch.

WATERPROOFING THE FOUNDATION

A dry basement is one of the requirements of good construction. When the site on which the house is to be located does not have good natural drainage it is best to waterproof the outsides of the walls below grade. No matter how much care is exercised in making concrete block or placing them in the wall it is not always possible to obtain absolutely watertight construction.

The simplest method of waterproofing is to paint the wall with hot tar or asphalt. When this method is adopted the precaution must be taken to have the wall dry as these materials will not adhere to a moist surface. In clay or other waterbearing soils, lines of drain tile should be laid around both the outside and inside of the wall footings and at least 6 inches below them to carry off excess water. These tile should be connected to a suitable outlet drain.

Sills and Lintels

To make sure that no moisture penetrates the walls at the sills, lintels, sill courses, lintel courses and joist courses and to prevent condensation on the inside walls at these places, all exterior building trim should be of two-piece construction to provide an air space between the inner and outer sections. The space between the inner and outer sections need not be greater than $\frac{1}{4}$ inch; a continuous air space is all that is required. Each division of lintel should be reinforced according to standard methods to carry the superimposed load.

Protection of Sills and Lintels and Other Ornamental Trim

Much of the beauty of ornamental concrete trim may be easily discounted by damage during construction. Adequate protection for these parts should be provided. A covering of building paper is often used. Where the trim is exposed to unusual danger it should be boxed in.

Another factor which contributes to making a structure attractive is clean walls. Workmen should be cautioned to be reasonably careful not to spatter the walls during erection. Any mortar which becomes attached to the block surface should be removed before the masons leave the job.

When the mortar has become firmly bonded to the wall surface it may be necessary to remove it with an acid solution. Muriatic acid diluted with water as required should be used for the purpose. This solution is usually applied with a stiff brush or broom. When the mortar has been removed, the acid must be immediately washed off the wall by scrubbing or flushing with water.

Plastering on Block with or without Furring

Some concrete block enthusiasts have recommended that interior plaster be applied directly to the block surface. These recommendations have been made despite the fact that it is customary to furr out the plaster for all other kinds of masonry houses. Furring and lathing costs only a trifle more when considering the total cost of the house and it assures a warmer wall. The better insulation thus provided effects a considerable saving in coal bills and provides a house which is cool in summer. In no case should interior plaster be applied directly on the concrete surface unless the house is constructed according to the following specifications:

The wall shall be constructed of two-piece block providing a continuous air space from the footing to the eaves and entirely around the building. All sills and lintels shall be of the two piece type and the inner and outer sections shall be separated so as to provide a clear air space between them. The outside of the foundation below grade shall be waterproofed as hereinbefore specified.

Sub-Committee A—Recommended Practice for Concrete Block and Tile Construction.

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W. G. Kaiser, *Secretary*
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REPORT OF SUB-COMMITTEE B— STANDARD CONCRETE BLOCK AND TILE SIZES

In general, all block and tile are made with hollow spaces or of two-piece construction so as to secure air space as an insulating medium, lighter weight, and to realize economy in materials.

There are five common types of concrete units.

Solid Units
Concrete Hollow Block
Concrete Building Tile
Solid Slab Block
Architectural Concrete Shapes.

A tabulation of sizes of block and tile, as now manufactured, is shown in Table 1. The name of the manufacturer is followed by the width, height and length of unit, the actual size of the block or tile being given. A block listed as 8″ wide, 7¾″ high, and 15¾″ long, is ordinarily referred to in practice as an 8″x8″x16″ block. These units are purposely made smaller to allow for the mortar joint which when added to length and height, produces a unit of full length and height.

As a help to the designer in determining the most desirable distance horizontally between doors and windows, and also the most desirable widths of door and window openings, Table II has been prepared. Lengths of wall sections and door and window openings should be, as far as possible, multiples of quarter block.

Table II gives the length of wall sections of from one to eighteen units by ¼ units. Your committee believes that a quarter length is as small a fraction of a unit as is necessary or desirable and that manufacturers of molds should adapt their machines and furnish suitable division plates for making, ¼, ½ and ¾ length block. By careful design it is often possible to utilize only two sizes of units—the full length and the half length units.

The purpose of Table III is similar to that of Table II. It is intended to help the designer determine the most suitable height for door and window openings and other vertical wall heights.

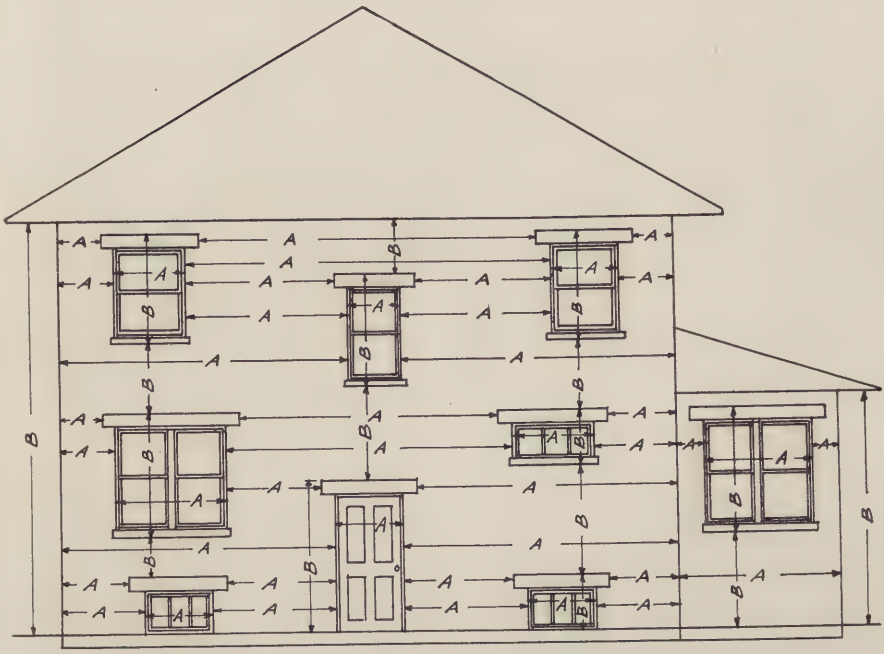
To explain the use of Table II and III, a drawing of a house elevation is presented. The distance "A" corresponds to the wall lengths shown in Table III and the distance "B" to heights specified in Table II. The purpose of both tables is to assist the designer in laying out the house so as to require no cutting of block which is costly, and which unless skillfully done produces a structure of unattractive appearance. Both tables will be found helpful in estimating the number of concrete units for a particular job.

Corner block, joist block, sills, lintels, and other special shapes should be furnished by the concrete products manufacturer so as to make it possible for the constructor to erect the building complete. Nothing detracts more from the appearance of a structure than poorly made and improperly fitted building trim. It has been suggested that jamb

TABLE I

STANDARD CONCRETE BLOCK AND TILE SIZE

Manufacturer of Mold	Height, Inches	Width, Inches	Length, Inches
Anchor Concrete Machinery Co. ..... Rock Rapids, Iowa	7 11/16	8–9–10–11–12	15 11/16 & 23 11/16
Bradstad Concrete Machinery Co..... Canton, So. Dak.	7 3/4	10	23 3/4
The Brandell Co.. ..... Cincinnati, Ohio	7 3/4	4–6–8–10–12	15 3/4
Ideal Concrete Machinery Co. ..... Cincinnati, Ohio	7 3/4	4–6–8–10–12	15 3/4–23 3/4
The Hamilton Concrete Machinery Co. Cleveland, Ohio	5	4–6–8–12	8–10–12
The Anchor Conc. Mach. Co. (Hobbs). Columbus, Ohio	3 to 12 ins.	3 to 12 ins.	3 to 24 ins.
The Besser Manufacturing Co..... Alpena, Mich.	7 3/4	7 3/4–9 3/4–11 3/4	15 3/4
Flexo Concrete Mold Co..... Cedar Rapids, Iowa	5 5/8–7 5/8	8–10–12	15 5/8–23 5/8
Zagelmeyer Cast. Stone Block ..... Mach. Co., Bay City, Mich.	7 5/16	8–10–12	15 5/16–23 5/16
The Federal Cement Prod. Co..... Cleveland, Ohio	5	8 1/2–12 1/2–16 7/8	12
The Ferguson Synstone Co..... Denver, Colo.	11 5/8	8–12	23 5/8
The Helm Brick Machine Co. ..... Cadillac, Mich.	7 1/4	10	23 1/4
Hydro Stone Co., Chicago.....	8 5/8–11 5/8	4 1/2 to 17	23 5/8
The Multiplex Concrete Mach. Co..... Elmore, Ohio	3 5/8–5 5/8–7 5/8	8–10–12	19 5/8
Peters Eastman Greer Co. ..... Indianapolis, Ind.	3 to 6 by ins.	7–10	20
Century Cement Machine Co. ..... Rochester, N. Y.	4 to 16 by ins.	4 to 20 by ins.	4 in. to 6 ft.
W. E. Dunn Mfg. Co. ..... Holland, Mich.	7 3/4	8–10–12	15 3/4
Francis Concrete Machinery Co..... St. Louis, Mo.	7 3/4	8–10–12	15 3/4–23 3/4
The Hayden Auto Block Mach. Co. ... Columbus, Ohio	7 3/4	4–6–8–10–12	15 3/4–19 3/4–23 3/4
Northwestern Steel & Iron Wks..... Eau Claire, Wis.	7 3/4	9–12	23 3/4
The Pettyjohn Co. ..... Terre Haute, Ind.	7 3/4	7 3/4	15 3/4–19 3/4–23 3/4
The Republic Iron Works ..... Tecumseh, Mich.	7 3/4	2–4–8–10–12	15 3/4
Stewart Mfg. Co. ..... Waterloo, Iowa	7 3/4	8–10	15 3/4



ELEVATION OF HOUSE ILLUSTRATING SETTING OF CONCRETE BLOCK.

block be used next to all doors and windows in places of the block with an ordinary end.

It is often difficult to select the exact size of block or tile for certain work. There are many factors to be taken into consideration, such as nature of building, size of wall space, weight of unit and architectural effect desired. Each size of unit has its particular uses. The size of joints is of importance. There is a great variation in this respect and the general feeling of your committee is that the $\frac{1}{4}''$ joint be used, and that this be borne in mind by the manufacturers of machines and molds so that equipment for making block and tile may be designed accordingly.

The question has arisen as to the best method for designating sizes of block, and your committee recommends the designation of height, width and length.

SUB-COMMITTEE B—STANDARD CONCRETE BLOCK AND TILE SIZES.

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H. D. Kerr, *Secretary*
Gilbert Cooper
G. M. Friel
F. J. Kinzinger
F. M. Leach
L. P. Willsea

TABLE II

TABLE SHOWING RELATION BETWEEN NUMBER OF COURSES OF CONCRETE BLOCK AND TILE AND THE HEIGHT OF WALL FORMED BY UNITS OF DIFFERENT SIZES

NUMBER OF COURSES	HEIGHT OF WALL SECTIONS FORMED							
	3 In. Block	4 In. Block	5 In. Block	6 In. Block	8 In. Block	9 In. Block	10 In. Block	12 In. Block
	Ft. In.	Ft. In.	Ft. In.	Ft. In.	Ft. In.	Ft. In.	Ft. In.	Ft. In.
1	0 3	0 4	0 5	0 6	0 8	0 9	0 10	1 0
2	0 6	0 8	0 10	1 0	1 4	1 6	1 8	2 0
3	0 9	1 0	1 3	1 6	2 0	2 3	2 6	3 0
4	1 0	1 4	1 8	2 0	2 8	3 0	3 4	4 0
5	1 3	1 8	2 1	2 6	3 4	3 9	4 2	5 0
6	1 6	2 0	2 6	3 0	4 0	4 6	5 0	6 0
7	1 9	2 4	2 11	3 6	4 8	5 3	5 10	7 0
8	2 0	2 8	3 4	4 0	5 4	6 0	6 8	8 0
9	2 3	3 0	3 9	4 6	6 0	6 9	7 6	9 0
10	2 6	3 4	4 2	5 0	6 8	7 6	8 4	10 0
11	2 9	3 8	4 7	5 6	7 4	8 3	9 2	11 0
12	3 0	4 0	5 0	6 0	8 0	9 0	10 0	12 0
13	3 3	4 4	5 5	6 6	8 8	9 9	10 10	13 0
14	3 6	4 8	5 10	7 0	9 4	10 6	11 8	14 0
15	3 9	5 0	6 3	7 6	10 0	11 3	12 6	15 0
16	4 0	5 4	6 8	8 0	10 8	12 0	13 4	16 0
17	4 3	5 8	7 1	8 6	11 4	12 9	14 2	17 0
18	4 6	6 0	7 6	9 0	12 0	13 6	15 0	18 0
19	4 9	6 4	7 11	9 6	12 8	14 3	15 10	19 0
20	5 0	6 8	8 4	10 0	13 4	15 0	16 8	20 0
21	5 3	7 0	8 9	10 6	14 0	15 9	17 6	21 0
22	5 6	7 4	9 2	11 0	14 8	16 6	18 4	22 0
23	5 9	7 8	9 7	11 6	15 4	17 3	19 2	23 0
24	6 0	8 0	10 0	12 0	16 0	18 0	20 0	24 0
25	6 3	8 4	10 5	12 6	16 8	18 9	20 10	25 0
26	6 6	8 8	10 10	13 0	17 4	19 6	21 8	26 0
27	6 9	9 0	11 3	13 6	18 0	20 3	22 6	27 0
28	7 0	9 4	11 8	14 0	18 8	21 0	23 4	28 0
29	7 3	9 8	12 1	14 6	19 4	21 9	24 2	29 0
30	7 6	10 0	12 6	15 0	20 0	22 6	25 0	30 0
31	7 9	10 4	12 11	15 6	20 8	23 3	25 10	31 0
32	8 0	10 8	13 4	16 0	21 4	24 0	26 8	32 0

TABLE III

TABLE SHOWING NUMBER OF BLOCK REQUIRED FOR WALL SECTION OF VARIOUS LENGTHS

Number of Block and Fraction of Block	LENGTH OF WALL SECTIONS							
	12-INCH BLOCK		16-INCH BLOCK		20-INCH BLOCK		24-INCH BLOCK	
	Feet	Inches	Feet	Inches	Feet	Inches	Feet	Inches
1	1	0	1	4	1	8	2	0
1¼			1	8	2	1	2	6
1½	1	6	2	0	2	6	3	0
1¾			2	4	2	11	3	6
2	2	0	2	8	3	4	4	0
2¼			3	0	3	9	4	6
2½	2	6	3	4	4	2	5	0
2¾			3	8	4	7	5	6
3	3	0	4	0	5	0	6	0
3¼			4	4	5	5	6	6
3½	3	6	4	8	5	10	7	0
3¾			5	0	6	3	7	6
4	4	0	5	4	6	8	8	0

TABLE III—Continued

Number of Block and Fraction of Block	Length of Wall Sections							
	12-inch Block		16-inch Block		20-inch Block		24-inch Block	
	Feet	Inches	Feet	Inches	Feet	Inches	Feet	Inches
4¼			5	8	7	1	8	6
4½	4	6	6	0	7	6	9	0
4¾			6	4	7	11	9	6
5	5	0	6	8	8	4	10	0
5¼			7	0	8	9	10	6
5½	5	6	7	4	9	2	11	0
5¾			7	8	9	7	11	6
6	6	0	8	0	10	0	12	0
6¼			8	4	10	5	12	6
6½	6	6	8	8	10	10	13	0
6¾			9	0	11	3	13	6
7	7	0	9	4	11	8	14	0
7¼			9	8	12	1	14	6
7½	7	6	10	0	12	6	15	0
7¾			10	4	12	11	15	6
8	8	0	10	8	13	4	16	0
8¼			11	0	13	9	16	6
8½	8	6	11	4	14	2	17	0
8¾			11	8	14	7	17	6
9	9	0	12	0	15	0	18	0
9¼	9	3	12	4	15	5	18	6
9½	9	6	12	8	15	10	19	0
9¾	9	9	13	0	16	3	19	6
10	10	0	13	4	16	8	20	0
10¼	10	3	13	8	17	1	20	6
10½	10	6	14	0	17	6	21	0
10¾	10	9	14	4	17	11	21	6
11	11	0	14	8	18	4	22	0
11¼	11	3	15	0	18	9	22	6
11½	11	6	15	4	19	2	23	0
11¾	11	9	15	8	19	7	23	6
12	12	0	16	0	20	0	24	0
12¼	12	3	16	4	20	5	24	6
12½	12	6	16	8	20	10	25	0
12¾	12	9	17	0	21	3	25	6
13	13	0	17	4	21	8	26	0
13¼	13	3	17	8	22	1	26	6
13½	13	6	18	0	22	6	27	0
13¾	13	9	18	4	22	11	27	6
14	14	0	18	8	23	4	28	0
14¼	14	3	19	0	23	9	28	6
14½	14	6	19	4	24	2	29	0
14¾	14	9	19	8	24	7	29	6
15	15	0	20	0	25	0	30	0
15¼	15	3	20	4	25	5	30	6
15½	15	6	20	8	25	10	31	0
15¾	15	9	21	0	26	3	31	6
16	16	0	21	4	26	8	32	0
16¼	16	3	21	8	27	1	32	6
16½	16	6	22	0	27	6	33	0
16¾	16	9	22	4	27	11	33	6
17	17	0	22	8	28	4	34	0
17¼	17	3	23	0	28	9	34	6
17½	17	6	23	4	29	2	35	0
17¾	17	9	23	8	29	7	35	6
18	18	0	24	0	30	0	36	0

Pretentious residence or modest bungalow, regardless of size or style, portland cement stucco on concrete block offers a practical, permanent and economical solution of any housing problem. Above, stucco on concrete block residence at Rochester, N. Y. Below, bungalow of same type of construction in a suburb of Chicago.

REPORT OF SUB-COMMITTEE C— BLOCK SURFACE FINISH AND STUCCO ON BLOCK AND TILE

The future success of the concrete unit for buildings will depend upon the appearance of the unit as much as upon its strength. As a general rule, the possibilities of the looks of the unit have been a minor consideration. With strength fairly well standardized, the appearance must be improved to make concrete units a product of recognized merit.

For best appearance concrete units should not be made in patterns to simulate other forms of masonry, particularly cut stone, but should always be treated as a separate and distinct building material having a surface finish peculiar to itself, which combines the beauty of natural stone and the ease of cleaning of terra cotta. The use of special aggregates and surface finishes opens fields for concrete block and tile construction previously untouched. With this in mind, your committee presents the following suggestions and recommendations.

Concrete building units may be divided into three distinct groups according to use:

1. Interior walls and partitions and foundations below grade.
2. Exterior finished walls.
3. Exterior walls to be covered with portland cement stucco.

CLASS I.

Block and tile for interior walls, partitions and foundations below grade require no special surface treatment.

CLASS II.

For all units which will form the finished walls of the building and which will not be stuccoed, it is recommended that some special surface treatment be given to expose the aggregates and add to the beauty, texture and variety of the surface.

The aggregates available for facing concrete units offer a wide choice and variation both in texture and color. Among the aggregates that may be used are screenings from different colored marbles and granites, river and lake gravel, feldspar, micaspar crystals and colored sands. In order to produce a greater color contrast than is obtained with colored aggregates and gray portland cement, white portland cement may be used. Mineral coloring pigment is sometimes mixed with the cement but it is not to be recommended for general use because of the difficulty in obtaining surfaces comparable in appearance, durability and economy with the other types of finish.

FACING CONCRETE BLOCK.

Methods for applying the facing vary with the type of unit and method of manufacture. It may be applied face down, face up or side face by methods which are a matter of common knowledge in well equipped plants manufacturing concrete products.

With selected aggregates any desired texture or color effect may be secured in concrete block. Variations in color and texture of block, in types of joints and in color and design of concrete trimstone give the builder of a concrete block house great latitude in the working out of individual ideas in architectural effects.

EXPOSING AGGREGATES.

Exposure of the aggregate can be accomplished in various ways. Among the methods used are brushing or scrubbing, acid washing, water spraying, tooling and rubbing.

Brushing or Scrubbing.

Brushing and scrubbing should be done while the concrete is still green but sufficiently hardened so that particles of the aggregate will not be removed. For this purpose water and a brush with stiff fibre bristles are used: when the concrete has become too hard, a little muriatic acid should be added to the water. Any surface treated with acid must afterwards be thoroughly washed with clean water to remove all traces of the acid.

Acid Wash.

The surface may be washed with dilute muriatic acid, applied with an ordinary scrubbing brush and then thoroughly washed with clean water to remove all traces of the acid. In some instances it has been found more economical to dip the unit in an acid bath instead of applying the acid by hand.

The strength of the solution will depend upon the age and hardness of the concrete but generally varies from 3 to 6 parts of water to 1 part of acid for scrubbing purposes and as strong as 1 to 1 for dipping.

Water Spraying.

This is done with a fine vapor spray as soon as the product is made. The outlet holes should be about the size of a pin and a water pressure of at least 40 pounds is required to give good results. The washing must be carefully done so as not to wash away the facing material. Spraying is necessarily confined to products removed from the molds as soon as made.

Tooling.

Block may be tooled in a manner similar to that used in treating natural stone, the process consisting of chipping or roughening the surface with a bush-hammer, chisel, or other hand or power tool. When colored aggregates are used in the concrete, a pleasing and beautiful texture may be secured. This method, however, is more costly than the various methods of surface finish previously mentioned.

For tooling, the concrete should be well hardened and at least three weeks old; but better results may be obtained by waiting until it is six or eight weeks old. After about three months the concrete becomes so hard as to make tooling difficult. It is to be understood that the ages mentioned above are only approximate as methods of manufacturing and curing the unit will have a great effect.

Rubbing.

With certain aggregates, such as marble or granite, rubbing will impart to concrete units a polish much the same as the original stone. After the concrete has hardened, it is rubbed with a concrete brick,

carborundum stone, or other commercial abrasive material or finished on a rubbing bed or "stone table" such as used at marble plants, etc.

CLASS III (*Portland Cement Stucco*).

Concrete block and tile laid in portland cement mortar are particularly well adapted to serve as a backing for portland cement stucco because they are composed of the same class of material as the stucco itself and afford an excellent bonding surface. For portland cement stucco finish the block or tile should be rough and of coarse texture but not weak or friable.

In applying stucco to block or tile the joints should be raked out or cut back at least flush with the face of the wall; no projections should be left. The wall should be brushed free from all loose particles and wet down and should be moist at the time the stucco is applied; if dry, moisture is absorbed from the stucco and a weak finish is the result; if too wet, a film of water prevents a proper bond.

The committee adopts as a part of this report the "Recommended Practice for Portland Cement Stucco" as published by the Portland Cement Association.

SUB-COMMITTEE C—BLOCK SURFACE FINISH AND STUCCO ON BLOCK AND TILE.

Edw. D. Boyer, *Chairman*
J. E. Freeman, *Secretary*
J. K. Harridge
H. G. Krum
A. C. Newberry
M. Wetstein

REPORT OF SUB-COMMITTEE D— TRIMSTONE AND BUILDING ORNAMENTS

EDITOR'S NOTE:—At a meeting of Sub-Committee D of the Committee on Concrete Block Houses, members of the Committee were so impressed by an account which Adolph Schilling, Chairman of the Sub-Committee, gave of his experiences in the manufacture of concrete trimstone and building ornament, that the Committee was unanimous in its opinion that no better Committee Report could be presented than to have Mr. Schilling set down his experiences as related to the Committee. That is the reason for the following matter being presented in a form other than the usual committee report style.

Fifteen years ago, when I undertook to make concrete attractive and pleasing to the eye, I accepted as definitely settled, the claim that concrete was strong and enduring. Since then my researches and experiments have been devoted entirely to developing the attractive and artistic possibilities of concrete and thereby make it interesting to the architect as a medium for embellishing his designs.

Twenty years of practical experience working with the natural stones used in monumental and building work, enabled me to appreciate the conditions that must be met to give concrete a place beside limestones, marbles, granites and clay products, in which architects had expressed their thoughts almost exclusively.

BUILDING TRIM

After proving to my satisfaction that cast stone could be made successfully, it required considerable missionary work to convince the architect of its merits and advantages as a medium to enrich design and to take a place largely held by terra-cotta, natural stones, etc.

In the making of concrete, after once thoroughly understanding the qualities of cement as a binder, one can learn to adapt many mineral products for use as aggregates in combination with, or in substitution for, the more common sand, pebbles or crushed stone.

The many examples of cast stone executed during recent years, are ample proof that the confidence of pioneers in the manufacture of high grade concrete products was well founded. Cut cast stone has been specified by progressive architects for high grade buildings everywhere. Now that the field has been opened, it rests with the individual to convince the architect, engineer and contractor that standard concrete products are what he wants, whether it is for the foundation or for ornamentation. It should be our purpose to establish cooperation that offers dependable concrete products to meet the requirements of the building trade in quality and quantity.

METHODS OF MANUFACTURE

In the manufacture of concrete trimstone and building ornaments in our plant, we have successfully used plaster, glue, wood, sand, cement and steel molds. A kind of mold which we use extensively is made of channel irons from 2 to 18 inches wide and from 4 to 8 feet long. If set on level tables or benches, the main part of a mold is provided

Trimstone, whether of simple or ornamental design, has long been successfully made of concrete. By using selected aggregates, it is possible to produce any desired color effect to harmonize with the main part of the structure. During construction trimstone should be boxed in, as shown at right to prevent it from being defaced or spattered with mortar.

that offers great latitude in use. The channel irons are held together by rods of different lengths. Wood or plaster inserts, plain or molded, determine the width, length and design of the unit to be cast. The work is poured with finished face down and can be solid or hollow. It may be surfaced with special material on any one side or on all sides if the volume of the product makes it more economical to use a core of concrete containing less expensive aggregates.

Some excellent work has been done by artists modeling directly with cement mortar. Most of these workers have attained their skill in this abroad. The most important work of this kind, to my knowledge, is a heroic group of the Crucifixion standing at Lynn, Mass. In this method of molding or modeling, the artist builds up his design with a permanent skeleton framework similar to when modeling in clay. Around this skeleton he forms a rough outline of his design in wire cloth or expanded metal and on this places a scratch coat of cement mortar. When this begins to harden, he models the final outline of his design. By varying the mixtures so as to in some degree control the setting of the cement, he can give the work the same freedom and spirit as if modeled in clay, and by using colored pigments of various shades, can produce practically any color effect desired.

Treating Surfaces

In our plant we use electrical rubbing wheels for smooth finish, acid for a grained texture and all of the tools used in the natural stone trade for tooled finishes, according to the effect desired. Any one or all treatments may be used on one piece. We have portable rubbing and tooling machines to surface extra heavy castings and stationary machines for smaller units. A cutting plant for natural stone is an ideal foundation to start an up-to-date cut cast stone business, even to its rubbing beds and gang saws.

Concrete of proper age can be treated just like any natural stone and it is my conviction that the success of concrete stone for building purposes rests in a close affiliation of the stone cast and the stone cutter. Only in this way will we be able to give concrete proper texture and the necessary qualities of dimension stone, so essential to the architect and builder for attractive and durable construction.

For six years my concrete stone and natural stone plants in Albany were under one roof and I found that such conditions were ideal for the production of a first-class composite stone of proper size and finish. The addition of a skilled stone cutter to every concrete products plant would be a source of profit and also result in better work. The stone cutter is trained to have dimension stone true to size and shape. The average worker in cement or concrete does not appreciate this essential point, but it is all-important with the architect and general contractor. It has taken many years to bring the craft of dressing natural stone to its present efficiency. The progressive concrete products man should study these methods and benefit by the experience of the trade whose product he must equal or better, if he is to secure the approval and patronage of the architect.

To the manufacturer or worker with concrete products, I recom-

Entrances constructed of concrete trimstone improve the appearance of the building, whatever its type. With selected, exposed aggregates harmonizing or contrasting color effects can be obtained.

mend the adoption of such methods as are applied successfully in other lines of manufacture in treating the surfaces of other products. In many cases instead of applying paint by brush, the article to be coated is immersed in the paint. This method can be adapted to acid washing of concrete products to remove the surface film of cement and expose the aggregates. Tanks of sufficient size are not difficult to build in the concrete shop, and immersing products in acid solution instead of scrubbing in the usual way will result in a great saving of labor and acid and produce a class of work that cannot be obtained in any other manner. In our plant we have two rectangular tanks, 4 by 4 by 16 feet, built of cement slabs grooved and bolted together, and six circular wood tanks 7 feet in diameter and from 2 to 4 feet deep.

Concrete should be from two to three weeks old before treating in an acid bath. Duration of time in the bath depends upon age of the product and whether rough or fine texture is desired. The time may range from 1 to 10 hours; a weak solution of 1 to 20 up to 1 to 10 is required. After the article is put in the tank, the solution does the rest. This method of treatment preserves the edges and details of the design and makes the surface uniform. Any hard spots not sufficiently affected by the acid bath can be separately treated after the article has been flushed with clean water. Care must be taken that the aggregates are nearly uniform in hardness, or the acid will eat soft portions out before the cement coating has been removed from the harder particles. I have had some very fine work spoiled because to obtain a certain effect, I had mixed black marble and crushed granite. The acid bath left only holes where the black marble had been, while the granite showed fine texture and natural color. To secure the black grain effect we now use copper slag.

Colored Concrete

To secure certain color effects, we use gray or white portland cement alone or mixed in certain proportions with the natural colored aggregates, sand, silica, pebble grit, marble, granite, etc., adding if desired suitable color pigments. It requires great skill and care to properly mix cement and color pigments to obtain uniform color effects without reducing the strength of the concrete. The importance of mixing the pigment thoroughly with the cement before adding aggregates should be fully appreciated. As a simple test to determine thorough mixing of cement and pigment, a handful of the dry mixture may be pressed under a sheet of stiff paper. If small specks of color show on the surface after the paper has been removed, it indicates mixing is incomplete. Such specks of unincorporated pigment will appear in the finished concrete.

The absorptive qualities of concrete during the period of hardening offer opportunities to color products by capillary action. In this method the color is deposited in the pores of the surface. The possibilities of this treatment are unlimited, based on knowledge of coloring values and good judgment—to prevent impairing the strength of the concrete.

Coloring solutions can be made to penetrate concrete 6 inches or more if the object is immersed while in a very green state, but it is rarely necessary to attempt a penetration of more than from 1/32 to

Detail of entrance to a private estate, near Washington, D. C. The aggregate is crushed quartz of light buff color, heightened by occasional spots of red and green. Note the sharpness of the arrises and mouldings.

$\frac{1}{8}$ of an inch as this fills surface pores, gives the desired color effect and is less expensive. The sulphates of copper and iron are the most suitable treatments for solutions to color concrete by capillarity. The concrete to be colored can be treated after it is a week old.

Concrete products used in construction where they must display load carrying capacity should not be subjected to the coloring bath until the concrete has attained its required strength, because the filling of the pores retards the progress of curing by the usual methods. Coloring by absorption is effective on concrete surfaces just as they come from the mold, or after they have been treated with tools. Surfaces that have been colored by absorption of mineral or metallic colors become more weatherproof and the action of the weather on the metallic salts is the same as on real metals, increasing the beauty of coloring by the usual oxidization noticed on bronze and copper. Concrete surfaces treated by this method become so dense and hard that they will take a polish. We have treated such surfaces in the same manner as marble, granite and metal, on polishing or buffing machines.

Such products as flower pots, vases and flower boxes, which we make by the wet cast method, will hold water the second day after cast and soon become so hard that when struck with a hammer they ring like a metal bell. Waterproofing compounds may help, but we do not regard them as essential. Rather, we consider that the thorough mixing of the proper amount of cement and water with graded aggregates is all-important.

Extensive tests made during the past three years with commercial waterproof paints showed excellent results. Common concrete can be made very attractive by one or two coats applied stipple fashion. This will not impair the grain or texture and does not produce the noticeable effect of painted stone. The method is especially to be recommended for dry or semi-dry tamped concrete, as the porous surface readily absorbs the paint and allows the pigment particles to fill the pores. The color effects obtained in this way are most economical; the color is uniform but lacks the richness and depth of shading that results from immersion in a bath of metallic salts. It has the advantage, however, of being applicable where immersion is not practicable. We have obtained two and three color effects by painting certain parts of an object before subjecting it to the coloring bath. The part so colored would not be affected by the bath.

The artistic possibilities of such treatment are limited only by the color sense and taste of the craftsman. If certain nonabsorptive aggregates are used, their natural color can be retained, while parts that are absorptive, especially the cement mortar, will take the desired color. In this treatment precaution should be taken in the use of acids in washing before immersion in the color bath, as the chemical action of the acids is likely to counteract the color values of the bath. Long practice and tests will give the experience necessary to gain the full benefit of this process. I have spent nearly ten years to obtain present results.

In the matter of surface finish, considerable headway has been made and most of the methods are well known to progressive concrete workers.

Any surface treatment is preferable to leaving the concrete as it comes from the mold.

CURING

Most of our trimstone and ornamental work is wet cast. It must set in the mold from 24 to 48 hours. We use a 4 per cent solution of calcium chloride for mixing water. During cold weather our shops are steam heated and kept at a temperature of 70 degrees. We have no curing rooms, but for quick curing use high-pressure steam in cylinders 6 feet in diameter and 70 feet long. We have commercially verified the tests made some years ago by the U. S. Bureau of Standards and reported in Technologic Paper No. 5. While these tests do not exceed 80 pounds pressure, we have hardened concrete up to 150 pounds pressure with the result that concrete two days old could be tooled under rapidly rotating carborundum wheels, cutting even aggregates without pulling out or fraying the edges. Compression tests showed strengths over 4,000 pounds per square inch at two days age and absorption less than 5 per cent. The higher the steam pressure, the less time required to harden. With 150 pounds we reduced the time to 4 hours; but no portland cement concrete product should be subjected to high pressure steam curing until it has taken its initial set. Steam curing should start preferably the day following casting.

Tamped concrete should be kept moist until it goes into the cylinder. As the initial expense of equipment and operating is considerably higher than curing rooms, only units that lend themselves to completely filling the cylinder space can be hardened economically. At present prices it costs about $20 to harden a volume equal to 900 cubic feet. The cost of a cylinder of the size mentioned is about $6,000 installed. These should be used in pairs to allow utilizing steam blow-off from one cylinder to the other after curing is finished.

SUB-COMMITTEE D—TRIMSTONE AND BUILDING ORNAMENTS.

Adolph Schilling, *Chairman*
J. C. Donaldson, *Secretary*
George Cuozzo
Frank Deni
Robt. Martin
Geo. Saffert
A. G. Swanson

One of the features of the National Conference on Concrete House Construction was an attractive exhibit of photographs, drawings and models of concrete houses. Concrete garden furniture contributed to the comfort and interest of the visitors.

REPORT OF SUB-COMMITTEE E— CONCRETE BLOCK PLANTS AND EQUIPMENT

Location

The most suitable location for any plant can be determined only after due consideration has been given to both the market in which the products will be sold and the availability of materials, the most weighty of which is the aggregate. Where a plant is to have a comparatively large capacity it will usually be found economical to locate the plant near the source of the aggregate, when freight rates on finished product permit of such a location on an economical basis.

Materials

Availability of materials is based upon the assumption that materials are either locally available or that they may be economically shipped in by rail or other method of transportation. Where it is possible to locate a plant at the site of aggregate, rail haul on aggregate is of course eliminated. The operator of the products plant, however, should compare freight charges on finished products for a plant located at the aggregate pit or other location which makes the aggregate readily obtainable, with the cost of transporting raw materials to a plant near the center of a market. It is usually not advisable to locate a concrete products plant midway between the source of raw materials and the center of the selling market as the combined freight charges on raw materials and the finished products will probably be greater than where the plant is located at either the source of raw material or at the market. When plants are located at midway points, double handling of cars is necessary while at plants located at the site of aggregate, only the out-bound cars hauling finished products need be handled.

These suggestions are made without reference to freight on portland cement as this commodity constitutes only about 25 per cent of the total tonnage. In the manufacture of concrete products any location must be such that all factors including water, labor, fuel and incidentals are readily procurable.

Plant Layout

Ample space should be provided so that materials and products can be handled with ease and dispatch. The space should allow for expansion of the business as often concrete products plants expand to several times their original size. In general, a plant should consist of receiving facilities, manufacturing room, curing rooms, storage space and shipping facilities.

Receiving Facilities

Materials as used in the greatest volume, follow in their respective order, aggregate, cement, water and fuel. Aggregate may be received in some form of horse drawn, or motor propelled truck or in cars or barges. Therefore, the method of unloading aggregate will depend upon the method of transportation. At present time it is customary to dump truck loads of aggregate over a grizzly through which

the aggregate will drop into a hopper feeding into a bucket elevator, which elevates the aggregate to bins, preferably placed overhead so that the material may be fed to the mixers by gravity. Where material is received in hopper bottomed cars a receiving pit should be constructed under the railroad track so the cars may be unloaded by gravity. If material is received in gondola cars it is customary to unload with shovels and to throw the material into the boots of the elevator or conveyor. This method is wasteful of labor and if the concrete products plant is sufficient in size the use of a power crane with a clamshell bucket enables unloading material more economically and quickly. The same crane may be used to build up storage piles of aggregate. These storage piles provide a reserve supply for winter work after pits are closed, or in case of a temporary emergency like a car shortage. Provisions should be made for economical movement of this material from piles to the working bins.

Material Storage Space

Enough space should be provided for the storage of materials to keep the plant in operation over an estimated period of non-delivery of materials. This period will vary from, say a week in the open season such as a delay caused by car shortage, or it may extend over several weeks or months during the winter season when pits in many localities are closed.

Manufacturing Rooms

The plant should be designed in such a way that the least travel will be caused in handling raw materials and finished products. In general, raw materials should be received either at one end or side of the plant and travel in the shortest direct line from the storage bins, through mixers, machines, curing rooms, storage yards and thence to cars or trucks for delivery. Machines should be placed in such relation to each other that materials may be conveyed from the storage bins to the mixer with the least labor and by the simplest system of handling practicable.

Finished Products

Ordinarily the delivery of materials to the mixer is either by gravity or with mechanical equipment. Concrete may be delivered by gravity or mechanical means to the molding machines. Finished products should be delivered to storage rooms by one of two methods, namely, racks which may be handled by jack-lift trucks or industrial cars on narrow gage tracks. Any other mechanical method of handling which may be on the market now or which may later be placed on the market should be considered on its merits and compared with the two suggested. Cured products should be conveyed from curing rooms to the storage yards or storage rooms by one of the methods suggested above for handling fresh products.

Curing

The method of curing should be such as to produce proper hydration of the cement.

Machinery and Placement

Machinery will consist of conveyors, concrete mixers, concrete products machines, boilers, power units such as gas engines, steam engines, electric motors, industrial cars, racks and jack-lift trucks. Elimination of belting and shafting is advisable and the use of individual motor drives is recommended. This will promote safe plant operation. It will also lessen the possibility of a total shut down such as would be caused by the breaking of a main belt or a main shaft. Motors should be placed in the safest and most practicable location. When bought attached to the machines the manufacturers in most cases will have the motors properly located.

Concrete Mixers

Concrete mixers should have ample capacity to provide concrete for all of the products machines. It is recommended that mixers be placed above the products machine so the concrete can be delivered by gravity. Products machines should be of good type and suitable to the requirements of the business. They should be placed on substantial concrete foundations, as the use of such foundations result in smoother operation and longer life of equipment. In the use of industrial cars, track should be carefully laid true to line and grade. Where racks and jack-lift trucks are used smooth level concrete floors should be provided in machine and curing rooms and concrete runways should be provided in the storage yard.

Conveying Machinery

Where possible, it will be advisable to obtain conveying machinery from manufacturers of established reputation who will furnish and install such equipment.

Boilers

Where steam curing is used boilers should be of such size and type as will furnish the required amount of steam without overloading. The steam capacity should be sufficient to cure the products and heat the building. The size of the boiler will vary with the size, number and type of construction of the steam curing rooms. It is recommended that a small curing room be provided for concrete trim or special units. In general, it is advisable to obtain the services of competent engineers to design and supervise the layout of concrete products plants.

Sub-Committee E—Concrete Block Plants and Equipment.

W. R. Harris, *Chairman*
W. A. Rogers, *Secretary*
Gilbert Cooper
S. L. Ekholm
E. Fellabaum
F. M. Leach
U. J. Meuer
E. F. Olsen
S. F. Wightman

REPORT OF COMMITTEE ON CONCRETE AND CEMENT ROOFINGS

Introductory

In presenting the following report on concrete roofing tile and cement asbestos shingles, your Committee desires to call attention to the great need for a wider use of fire resistive roof coverings. It is estimated by the National Board of Fire Underwriters that of the 23,203 dwelling house fires reported in 1917, which caused aggregate losses of more than $66,000,000, that over 20 per cent were caused by the ignition of inflammable roofs. Concrete roofing tile and cement asbestos shingles are the most fire resistant types of roofing known, thereby contributing to the safety of property and occupants of dwellings by eliminating the most hazardous fire exposure to which dwelling houses are subjected.

Concrete roofing tile and cement asbestos shingles are moderate in first cost and susceptible of most pleasing architectural development.

The selection of roofing is one of the most important problems confronting the architect as it so largely determines the appearance of the dwelling. The wide variety of types and colors readily available in these types of roofing make possible a selection of designs of rugged effect, casting bold shadows where advisable. This variety is of a special value where a number of houses are to be built of similar material or general design in the immediate vicinity. Without altering the structural features below the roof-line, the architect can, by the exercise of taste and ingenuity, so vary the designs and shades of roofs on adjacent houses that the monotony so noticeable in many large housing developments is largely avoided.

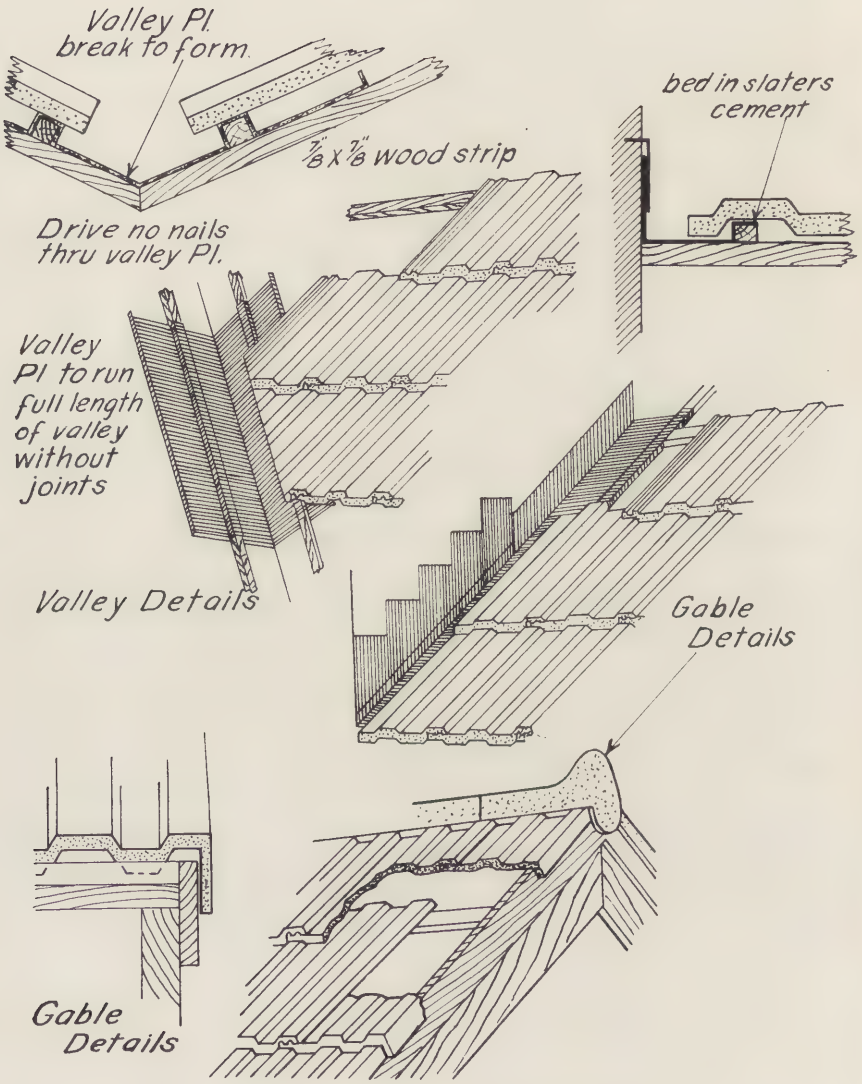
Concrete Roofing Tile

Concrete roofing tile are composed essentially of portland cement and suitable aggregates. They should meet the requirements of the American Concrete Institute Proposed Standard Specifications for the Manufacture of Concrete Roofing Tile, Standard No. 22, and suggested addenda as embodied herewith under "Specifications."

They are generally produced in standard size of 9 3/16 inches by $14\frac{3}{4}$ inches, over all dimensions. Their weight is approximately $5\frac{1}{2}$ pounds each. One hundred and fifty tile are required per square of 100 square feet which weigh when applied in place, about 825 pounds. They are usually furnished with double side lock for efficient exclusion of weather. Owing to their accurate plane surfaces and freedom from warpage, 3 inch end lap is sufficient for good construction.

They are commonly furnished in standard colors of red, green, brown and natural gray and can be furnished in various other special shades, if desired. Standard details such as ridges, hip rolls, gable starters, gable finishers and finials are regularly furnished by manufacturers.

Concrete tile roofs are permanent requiring no maintenance expense and are practically indestructible. They improve with age and



Typical construction details of concrete tile roof.

are exceeded in durability by no other known material. Joints between the tile permit expansion and contraction thus eliminating danger of destruction due to temperature changes. They are unique in the high salvage value afforded, in event of wreckage or alteration of structures on which they are placed. Concrete tile are permanently attractive, their surface being smooth and non-absorptive; they do not discolor.

Concrete roofing tile are moderate in first cost. The reduction in insurance premiums, will much more than pay for the interest on the additional investment over less fireproof roofings. Their rich and substantial appearance enhances the sale value of the house on which they are applied, by several times their total cost.

They reduce fuel consumption in winter and assist in keeping a house cool in summer, the dead air space between sheathing and tile being a most efficient insulator.

Their uniform size and true surface render it possible to erect them more rapidly and economically than any other roofing tile product and has led to their favorable recognition by labor. They have been approved as loan risks by financial interests.

Recommended Practice for Building on Which Concrete Roofing Tile Are Applied

Rafters should be not less than 2 by 6 inches on 20-inch centers.

The use of collar or tie beams is recommended. Roof sheathing should be shiplapped, at least 1-inch material, well seasoned and closely laid.

Gable facia or barge rafter should be placed with top edge $1\frac{1}{8}$ inch above roof sheathing to come flush with top of nailing strip.

Flashing and sheet metal work should be in place before tile laying is commenced. Aprons and counterflashing, under which felting extends should be raised 3 inches for proper laying of felt.

Specifications for Concrete Roofing Tile

Concrete roofing tile shall be furnished and applied in accordance with the following specifications. American Concrete Institute, Standard No. 22—Proposed Standard Specifications for the Manufacture of Concrete Roofing Tile and addenda as follows:

1. These specifications apply to concrete roofing tile aproximately 9 by 15 inches over all.

2. Concrete roofing tile meeting the requirements of these specifications may be used in building construction.

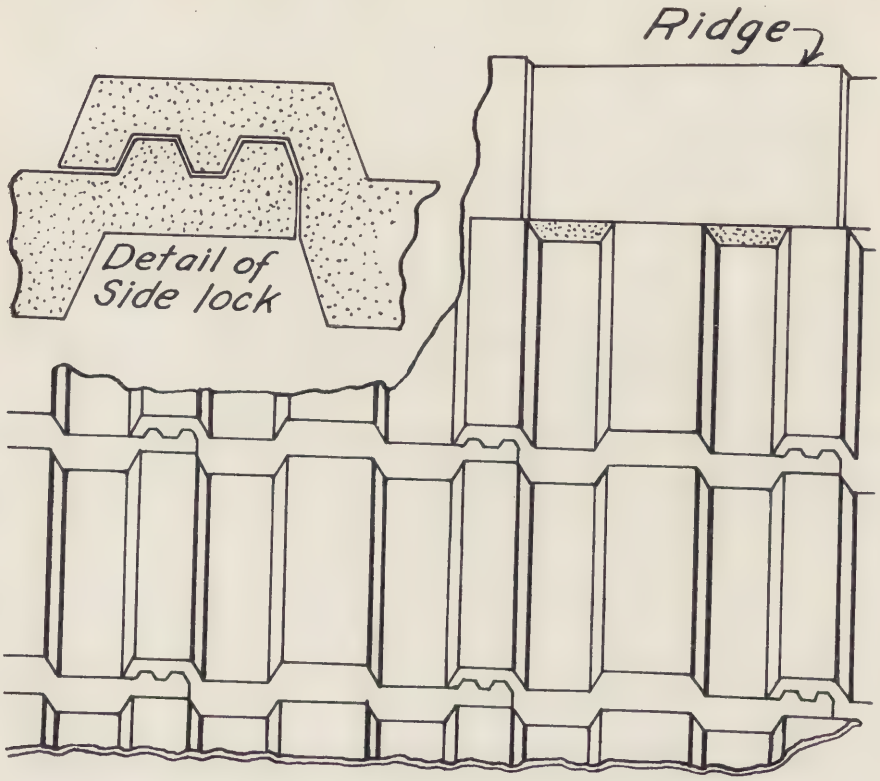
3. Concrete Roofing tile must be subjected to load test.

Tests shall be made on full size samples. At least 10 samples must be provided for the purpose of testing and must represent the ordinary commercial product.

4. The breaking load shall average not less than 150 lb. per tile when the load is applied in accordance with the method described below. Lots of tile intended for building construction may be rejected if more than 10 per cent of the samples tested break at loads of less than 100 pounds.

5. Tile shall be tested with weather face up. The tile shall be supported under the lugs near the ends if the tile have lugs and in no event shall the span be less than 13 inches. The support under one end shall be rigid and the support under the other end shall rest on a roller bearing to allow for variation in the under surface of the tile.

The load shall be applied in the center of the tile by placing a rigid bar having a semi-circular bearing across the tile midway between the



Concrete roofing tile. Detail showing end view and side lock.

points of support. From this cross-bar shall be suspended a bucket-like receptacle which shall be loaded with shot, sand or other suitable material until the tile breaks. The method of loading is shown in the accompanying diagram.

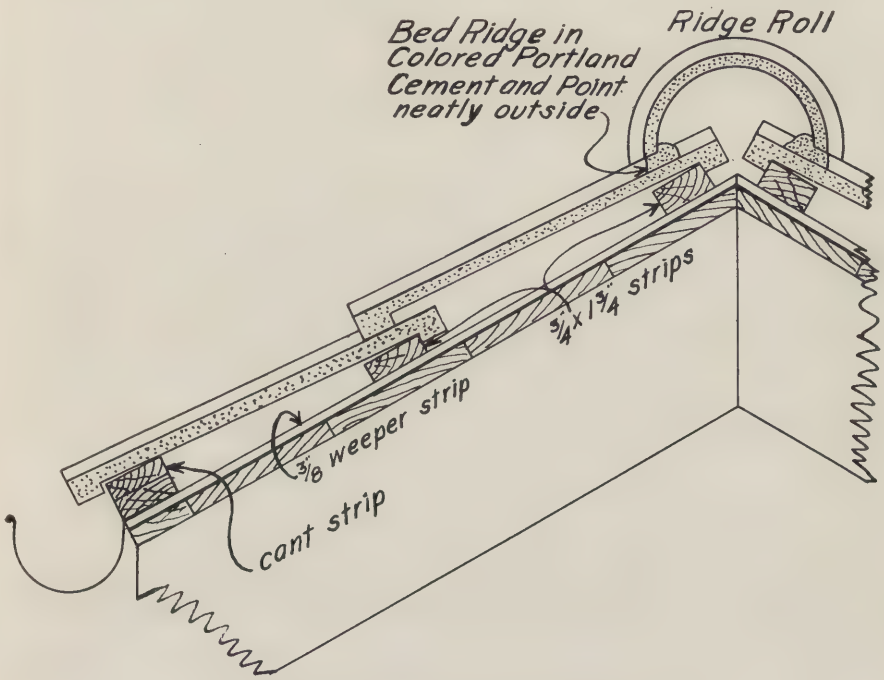
6. Portland cement shall be used in the manufacture of concrete roofing tile and shall meet the requirements of the current Standard Specifications for portland cement adopted by the American Society for Testing Materials.

7. Aggregates used in the manufacture of concrete roofing tile shall be of such a nature as will produce the quality of the tile required by these specifications—and the following addenda:

Absorption of concrete roofing tile shall not be more than 6 per cent in 48 hours. They shall not be warped more than $\frac{1}{8}$ inch from plane surface and shall not vary more than 1/16 inch in thickness.

Concrete roofing tile shall be laid in accordance with the following specifications: Over the sheathing, lay approved 12 lb. or heavier, tile felt roofing paper, laid parallel to eaves. Felt shall be lapped not less than half the width of the sheet on every course. An extra ply of felt shall be laid next the eaves. Cap all hips longitudinally with extra ply of felt at least 12 inches wide. In valleys, lay one extra ply, full sheet wide, longitudinally. Where felt extends against vertical walls, same shall be carried at least 6 inches on vertical surface under counter flashing.

The roof shall be watertight after applying the felt. The roofer



Concrete roofing tile. Typical cross section of roof.

shall install valley plates as furnished, cut and broken to fit, by the sheet metal contractor in accordance with illustration attached hereto.

Over felting lay 3/16 inch strips on 18-inch centers from eave to ridge. Nailing strips $\frac{3}{4}$x1$\frac{3}{4}$ inches shall be nailed above lath (see sketch). The roof shall be accurately laid out with rule and chalk line by the roofer and when finished, courses shall present a straight and uniform appearance when viewed vertically, horizontally or diagonally. All hip and ridge roll shall be laid accurately and bedded in 1:3 portland cement mortar (see detail) colored to match balance of roof with approved mineral color. The roofer shall guarantee his work to be watertight and remain so for a period of 5 years from date of completion and to replace any defective tile or tiles appearing during this period.

Your Committee recommends that in view of the extensive and rapidly increasing use of concrete roofing tile, that the immediate de-

velopment of automatic machinery for producing these shapes economically be strongly encouraged. There is immediate need for such machinery.

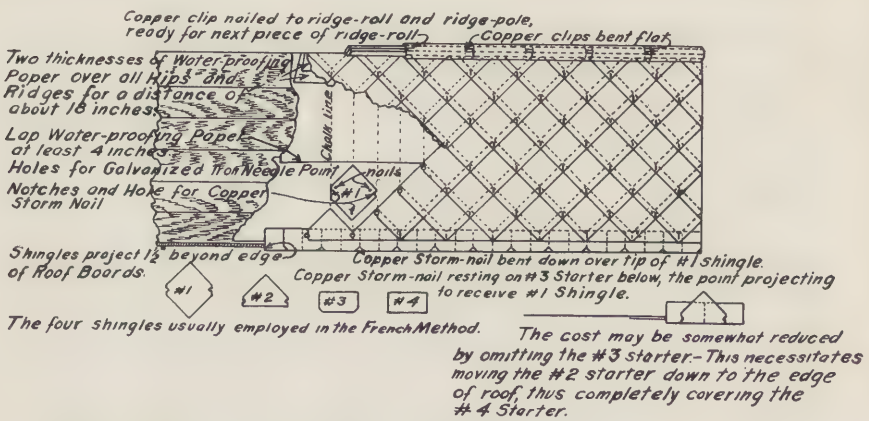
The use of steam in curing the tile assists very materially in producing high grade products and the use of this method should be insisted upon by users.

We also recommend that manufacturers be encouraged to investigate the use of light weight aggregates in view of determining their suitability in developing roofing tiles retaining all of the architectural and structural features embodied in the present product and of minimum weight.

We also note that the establishment of erection and service departments by reputable manufacturers has become well-nigh universal and we recommend that this policy be encouraged.

Cement Asbestos Shingles

Cement asbestos shingles are composed essentially of portland cement and asbestos fibre, about 75 per cent of the content being portland cement. They are of Austrian invention, and large amounts of capital and effort have been expended in perfecting their commercial production. We believe full credit is due Dr. Richard V. Mattison of Ambler, Pa., for his efforts in this field.



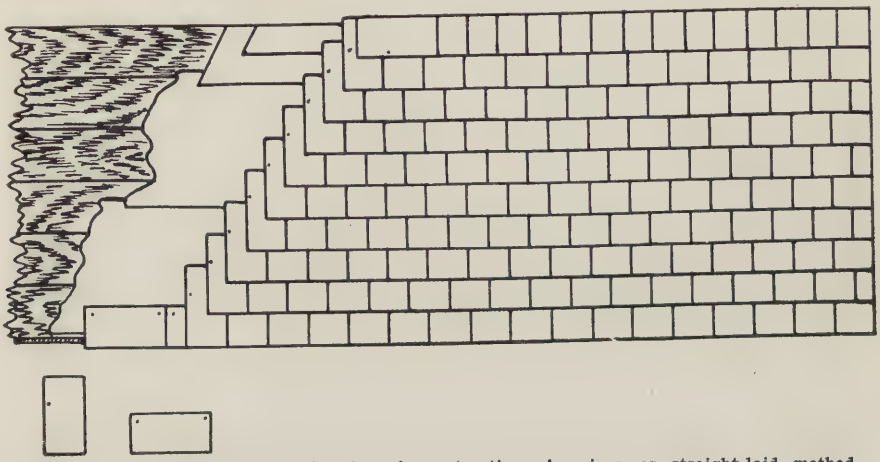
Cement asbestos shingles. Details of roof construction, French or diagonal method.

After exceptionally thorough mixing, which is accomplished in machines somewhat resembling pulp beaters commonly used in paper mills, the pulpy mixture of cement and asbestos is dropped on a wide moving felt conveyor, whence it is conveyed between heavy rollers to a pressure roll on which successive layers are wrapped. The material is thus built up in plies. When the desired thickness is reached, the sheets, still wet, are cut off and run through a cutter where the shingles are cut into uniform sizes. A number of other operations are performed, the shingles being pressed to remove the bulk of the moisture and produce a smooth surface. They are then seasoned, trimmed and drilled.

Cement asbestos shingles are approximately 3/16″ thick. They average in weight about 435 lbs. per square (100 square feet) for the American type and about 275 lbs. per square for the French or diagonal

type. They are made in a variety of shades and are commonly furnished in standard colors of grey, red, brown, dark slate and green. They are available in various shapes—commonly furnished in rectangular and diamond shaped shingle forms. The application of these shingles is so simple that any carpenter skilled in applying wooden shingles, or any roofer, can apply them in minimum time, as all nail holes are punched in asbestos shingles during the course of manufacture.

Methods of applying these shingles are illustrated in the accompanying sketches. The first shown is the French or diagonal. The second, the American, or straight-laid method. The diagonal method is much cheaper, as it does not require as many shingles per square, more of the surface being exposed than in the American method. However,



Cement asbestos shingles. Details of roof construction, American or straight-laid method.

the diagonal method does not afford nearly the same opportunity for architectural development that the straight-laid method does.

Long experience has proven the fact that asbestos shingles give very pleasing effects not only to the more expensive residences, but also to working men's houses, and group dwellings. The White-Haven Sanitarium at Mt. Alto, Pa., used asbestos shingles on every building not only for roofing, but for siding as well. The United States Government has also seen fit to utilize them at the West Higham, Mass., Naval Base, where they used 60 carloads of asbestos shingles for the roofing and siding of their magazine buildings, thus fireproofing the entire structures, which is of paramount importance in this class of building.

COMMITTEE ON CONCRETE AND CEMENT ROOFINGS

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ORGANIZATIONS WHICH HELD JOINT SESSIONS WITH THE NATIONAL CONFERENCE ON CONCRETE HOUSE CONSTRUCTION

American Concrete Institute
Associated General Contractors of America
Building Officials Conference
Concrete Block Machinery Association
Concrete Mixer Association
Concrete Products Association
Concrete Roofing Tile Association
Western Association of Concrete Laundry Tray Manufacturers

REGISTRATION LIST

National Conference on Concrete House Construction
February 17, 18 and 19, 1920
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